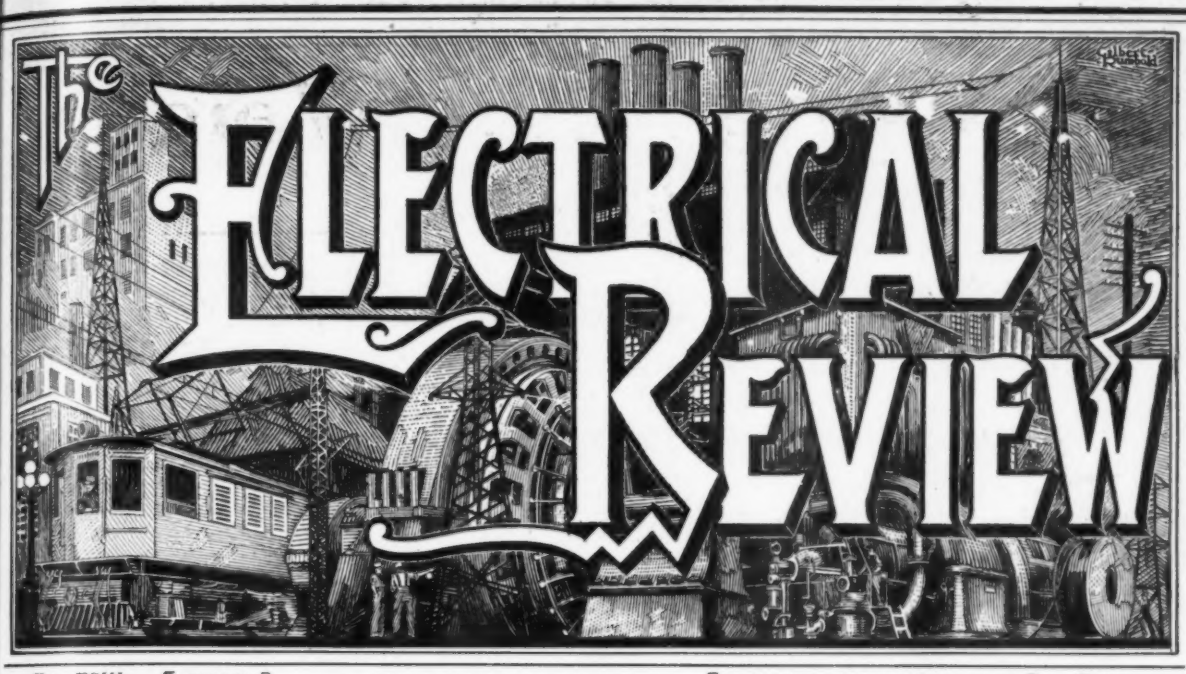

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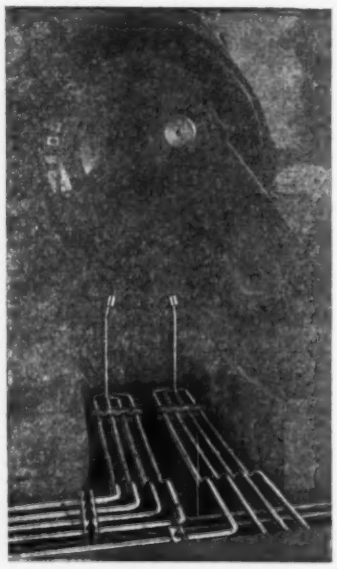

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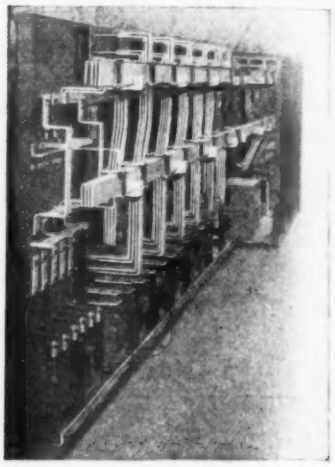

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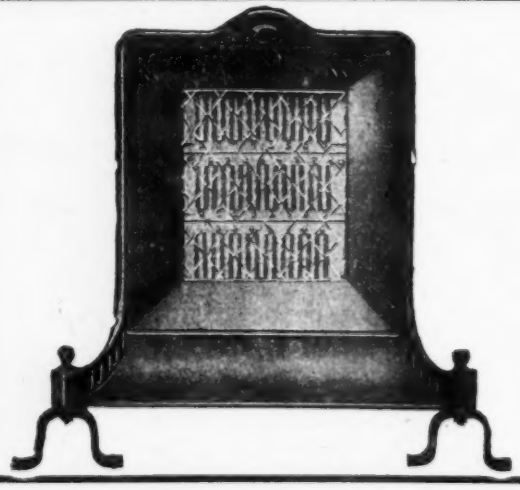

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VOL. XCIII. OCTOBER 5, 1923. No. 2,393.

ELECTRICAL REVIEW.

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THE BROADCASTING REPORT.

To arrive at a compromise is always a difficult and slow process, and, sad to say, the quality of the resultant product is not always in direct proportion to the time expended on its attainment. Sometimes, indeed, it is in inverse proportion. About a year ago the Post Office made a solemn agreement with the British Broadcasting Co. as to the methods to be employed in wireless broadcasting, the details of the apparatus to be used by the public for receiving, and the nature of the licences to be issued by the Post Office. The company faithfully carried out its obligations; the Post Office, however, was lax. It issued "experimental" licences to everyone who wished to construct his own set; it carried out no inspection whatever to see that the sets so constructed conformed with the technical conditions of the licence; and, with its eyes open to the enormous number of persons (now estimated at 200,000) using receiving sets without any licence at all, it took no steps to track them down and to proceed against them. When matters had come to a head, and it seemed more than probable that the just revenues of the British Broadcasting Co. might be so impoverished that it could not afford to continue to provide good programmes and service—and after some recrimination between successive Postmasters-General—a Committee was established to investigate the whole question. Its report was completed and presented to the Post Office over a month ago, and, as will be seen in the abstract published in another column of this issue, it recommended considerable modifications in the existing agreement between the Post Office and the Broadcasting Co. Neither the Committee, nor even Parliament, could have any power to cancel this agreement, and it will be obvious to all who read the Committee's report that the Broadcasting Co. could not accept the modifications proposed, which might deprive it of a further large percentage of revenue. It must not be forgotten also that the company's net profit is limited to 7½ per cent. on its capital. In these circumstances the Postmaster-General followed a wise course in not publishing the Committee's report until the terms of the new agreement had been settled with the Broadcasting Co., and one cannot be surprised that the terms of this compromise, a *résumé* of which we publish this week, together with the abstract above-mentioned, should have taken a month to formulate.

Briefly, the result is that on complete sets sold to the general public, a B.B.C. fee will have to be paid as hitherto, but on a much reduced scale, and the user will have to hold a licence costing 10s. per annum, as at present. The existing 10s. experimental licence will continue, but holders of such licences must sign a declaration that they will not "use" the broadcast programmes except for experimental purposes! A new "Constructor's licence" is to be issued at 15s. per annum for those people who construct their own sets and are not *bona fide* experimenters within the narrow and not the broader meaning of this term. They will presumably be expected to conform with technical regulations to prevent them from interfering with other listeners, and it is to be hoped that the same rule will apply to the 200,000 unlicensed listeners, who must now take out licences by the 15th of this month. These 200,000 include some thousands who have been a veritable nuisance to serious and law-abiding listeners during recent months. By constructing sets without that knowledge which would qualify them for an experimenter's licence, they have nightly been producing on their own account disturbances in the ether audible to other listeners and

seriously impairing not only enjoyment of the programmes from the local stations, but also the possibility of accurately tuning-in and listening with comfort to distant ones. These "reaction merchants," chiefly possessors of home-made one- to three-valve sets, and incapable of hearing themselves the disturbances they are producing, are known to the elect as "squeakers." Anywhere near London one can hear them howling like a pack of wolves whenever 2 LO makes a late start or during an interval, and screeching like owls when the performers come to a *piano* passage. The Post Office has decided that listeners at present unlicensed are not to be proceeded against, provided that they conform with the law and take out licences without delay. One naturally does not appreciate the idea of deliberate and wilful breaking of the law being overlooked, but as the Broadcasting Co., which has been the most injured party, has agreed, the law-abiding listeners whose pockets, at any rate, have not suffered, must accept the position. It will obviously be an impossibility for the Post Office to make an early inspection of the apparatus set up by the existing experimental licence-holders, estimated to number about 80,000, the unlicensed listeners estimated at about 200,000, and new listeners who take out constructor's licences, who will probably number some thousands a week. Consequently, we fear that the "squeakers" will have a free run of many months, even if outraged genuine experimenters track some of them home with direction-finders and report them to the authorities. However, it is to be hoped that, notwithstanding the difficulties, the Post Office will take a proper view of its responsibilities in this matter. Real and thorough inspection must be started forthwith, and it must be a condition of every constructor's licence that the licence-holder is bound to admit the Post Office inspector to inspect and test his set at any reasonable time.

There is another point which may be mentioned in connection with the new constructor's licence. As is well-known, sets can now be purchased for home "construction" consisting of every component part, leaving the purchaser only to screw the components on to a panel or board (which is often itself supplied as one of the components, ready drilled and tapped), and to connect up a few wires in accordance with instructions issued with the parts themselves. It is a simple way of evading the B.B.C. fee. If it is practised by manufacturers who are members of the B.B.C., no great harm is done, for they can put their profit on the price of the components, and are only depriving their own company of the B.B.C. stamp fee. For their own protection, also, these sets of parts and the circuit diagrams given with them would have to be innocuous from the point of view of disturbance. Sets made in this manner by firms outside the B.B.C. are certainly a form of unfair competition; but it is difficult to see how this can be prevented if the resultant sets conform with the technical regulations. There will, however, no doubt be cases in which such collections of components are arranged so that, when set up, they involve the use of reaction in a manner or to a degree not permitted by the terms of the Post Office licence, and the Post Office should acquire powers to enable it in such cases to come down directly on the maker or seller instead of having to wait until it could detect a user.

With regard to foreign competition, the Postmaster-General recognises that the B.B.C. is entitled under its agreement to a measure of protection, and imposes on constructors the obligation to use British-made components, whilst the importation of complete sets appears to be barred during the term of the agreement. According to Press reports, some manufacturers are thoroughly satisfied with the situation, but others are dubious as to the effectiveness of the protection accorded, not, we think, without reason.

In conclusion, we must express our satisfaction that the general position with regard to broadcasting is now cleared up—for the present at least—and we look forward to a great development of the radio side of the electrical industry during the coming winter months.

UNEMPLOYMENT SCHEMES AND ELECTRICITY SUPPLY.

The last published report of the Unemployment Grants Committee, which records its proceedings up to June 28th, gives some figures which are interesting from the point of view of the electricity supply industry. The beneficiaries of the grants under this Committee, to which we refer below, are local authorities only or bodies not trading for profit, so the electricity schemes referred to are entirely municipal. A rather surprising feature is the comparatively small use, as regards their electricity undertakings, which local authorities had made of the seemingly advantageous terms offered by the Grants Committee. The Committee offered two sets of terms. The one offer was to assist schemes by a grant of 60 per cent. of the wages bill of additional men taken on for work put in hand or accelerated solely on account of the pressing need of finding work for the unemployed. A second offer, with regard to revenue-producing works, was to make grants equivalent to 50 per cent. of the interest on the necessary loans for five years. The total amount of the grants under the first offer (60 per cent. of wages cost) devoted to electricity undertakings amounts to £49,751. This is only 1½ per cent. of the total amount allocated for all classes of work to local authorities. Under the second offer, viz., the "interest on loan" offer, the loans sanctioned for electricity undertakings amounts to £2,329,471, or about 8 per cent. of the total allocated for all classes of works. In view of the great preference which the Grants Committee evinced for "revenue-producing" rather than other works, it would have been thought that local authorities might have taken advantage of the assistance proffered to have "accelerated" electricity schemes to a much greater extent, especially as the extension of electricity supply is admittedly one of the factors in resuscitating the industry of the country generally and so reducing unemployment permanently. Further, the financial assistance would obviously have a good effect also indirectly in so far as it would naturally reduce the final cost of supply to the consumer.

As regards the future, the Grants Committee issued a circular to local authorities, dated July 6th, asking for proposals for the forthcoming winter. So as to encourage revenue-producing work, the terms are made more generous and provide payment of 50 per cent. interest during 15 years, or the full period of the loan, whichever is the less, on loans raised for not less than 10 years. The Committee expresses the hope that these more favourable terms will "secure the acceleration of works which would not be put in hand at the present time." Among the special classes of work thus referred to are electricity undertakings, and the Committee seems to indicate that it specially favours electricity, gas, water, and tramways since, in addition to providing work locally, they also would help "certain industries which are suffering from severe unemployment."

Mr. Edward Cross, chief electrical engineer of the Rotherham Corporation electricity supply undertaking which has experienced almost phenomenal development in recent years, touched upon this important matter in his presidential address to the members of the Rotherham Technical Institute. He expressed the opinion that both municipalities and companies owning electricity supply systems had been far too conservative in considering extensions. He said that there was not within his knowledge a single case of excessive optimism in this respect, and he welcomed the signs of a tendency now for other towns to follow the lead that Rotherham had given. The Hackney Borough Council has lately been giving attention to a large development scheme which, while it will create work for unemployed, will also secure continuous electrical pro-

gress in the district and add to the progressive electrical reputation of Mr. Robinson's undertaking among the metropolitan boroughs. It would be interesting if active competition could be aroused between all the supply authorities in, say, the metropolitan area, to see which district could within a given period secure the most thorough electrical saturation.

We hope that the Electricity Committees of many municipalities are seriously considering the proposals of the Grants Committee, and, if circumstances permit, will make full use of any opportunities thus afforded to extend and develop their electrical undertakings to the good of themselves, the public, the manufacturer, and last, but not least, the unemployed.

Capital and Labour Both.

Mr. Mackenzie King, the Prime Minister of Canada, made some timely comments on the relation of an economic situation to the question of Empire settlement in an interview accorded to *The Times* on his disembarkation at Liverpool. It had been suggested that Canada had been backward in taking advantage of the Empire Settlement Act, and Mr. Mackenzie King explained that while Canada needs men, she also needs money, and the investment of money, and the employment of labour, must go hand in hand. It is not necessarily the right thing to admit a large body of men into one part of the Empire in order to relieve the pressure due to surplus in another part. If Canada had stimulated too quickly the tide of immigration when the present Administration took office, she would only have provoked a serious industrial situation in her own borders because unemployment already existed there to a considerable degree. Happily, however, the holding of the Conference here takes place when the revival of trade and industry in Canada is being felt, and this may justify an enterprising immigration policy, but there must also be a new flow of British capital for investment in Canada. It is remarkable to note that while British investments in Canada stand at about what they were in 1914 ($2,700,000,000), American investments there have advanced from $750,000,000 to $2,500,000,000, and much of the latter is in factories, lands, mines, or industrial bonds. Unless the inflow of British capital advances substantially, it may be that in a year or two American capital in Canada will predominate over British. Of course, what happened after 1914 is not difficult of explanation—the production of war manufactures, and the accumulation of war wealth in the States, the American financing of munitions production in Canada, and our own heavy expenditure on the European conflict, created the opportunity. But to-day, as Mr. Mackenzie King says, if Canadian investments are worth while for the Canadian and American investors, there should be no lack of confidence on the part of British capital. It is that word "confidence" that means so much to us all. As world confidence returns, there will be lifted that restraint which now restricts the investment operations of our people. If only the Economic Conference can do something to relieve things in that connection it will lead the way for the freer flow of money and the wider opening of the gates of overseas territories to the children of the Empire who languish here while lands afar await development.

The Swedish Locomotive Question.

The Swedish State Railway authorities have received new offers for the supply of 50 electric locomotives for the Stockholm-Gothenburg railway, but for the moment the amounts of the tenders are being withheld from publication, as it is stated that attempts are being made to get further reductions in the prices. As was mentioned a few weeks ago, the native Swedish offers amounted to 231,000 kronen, whereas the German works tendered at 195,000 kr. per locomotive. The authorities desire to place the contracts in Sweden if possible. The general manager of the State railways is reported to have stated that the price policy of the recently formed ring of Swedish electrical firms is illustrated by the fact that before the constitution of the ring the five locomotives required for the Swedish frontier railway were paid for at the rate of 2.29 kr. per kilogramme, but a rate of 2.93 kr. was now demanded for a much larger number of locomotives of the same type. A contradiction has been issued of a report that a Swiss firm has quoted a price of about 200,000 kr. per locomotive or about the amount which the railway authorities reckoned they would have to pay.

German Tramways.

The unfortunate economic situation of the majority of the electric tramways and light railways was discussed at length at the recent general conference of the Association of German Tramways held in Berlin. It was emphasised that if thorough remedial measures were not soon rendered available, many of the tramway undertakings would collapse. Severe criticism was directed against the enormous prices charged for coal and iron and steel products under the auspices of the National Coal Syndicate and the self-governing organisation for the iron and steel industry.

A Report on Trade Union Statistics.

The Report on the Trade Unions by the Chief Registrar of Friendly Societies is now available. Like a good many other blue books, it suffers from the trouble of being a trifle belated, as the report only deals with the 1921 returns.

The report gives, however, a full quota of statistics relating to the finances and membership of the various registered unions. In the totals it shows that the membership declined in 1921 from nearly 7,000,000 to little more than 5,500,000, and that funds were reduced by about £5,000,000.

As regards the electrical industry, we notice that the Electrical Trades Union membership declined from 57,292 in 1920 to 45,561 in 1921—presumably the secessions were mainly in the contracting or general engineering industries; and the funds decreased from £79,244 to £21,822.

The difference between the unemployment benefit paid in the two years was, of course, very marked, that for 1920 being only £21,637, whereas in 1921 it amounted to the alarming figure of £118,265. There is also an item under the heading of Dispute Pay, the amount in the two years being not very different, which indicates presumably the same level of belligerency or peacefulness.

The Electrical Power Engineers' Association maintained its numbers, the membership in 1920 being 4,156, and in 1921, 4,149. The funds increased from £4,606 in 1920 to £8,330 in 1921. As regards disputes, the position is reversed, as there is £1,072 down in 1920, which was apparently a stormy period compared with 1921, which only shows £25.

The Electricity Supply Commercial Association apparently had but a brief spell of glory for it numbered 1,745 members in 1920, falling to 641 in 1921. It will be remembered that this clerical union formed at one time part of the National Joint Board, but was obliged by circumstances to retire. The National Association of Supervising Electricians appears to pursue an even and uneventful course, its membership in 1920 being 174, while in 1921 it experienced a small accession which brought it to 175. There was apparently a slight ruffling of the waters in 1921, as £42 is down for dispute pay.

There are, of course, concerned in the electricity supply industry big memberships in other unions, but these unions cover too wide an area for their figures to be of any significance or any particular interest to the industry.

D

BEARING CURRENTS AND THEIR SUPPRESSION.

By Dr. A. FRAENCKEL.

1. Introduction.

The phenomena of currents in the bearings of electrical machines have been known for a long time. Nevertheless, it still happens occasionally that the rules for obviating such currents are overlooked during manufacture. They are therefore reviewed briefly here.

2. The General Causes of Bearing Currents.

The path of bearing currents runs through the shaft, bearings, and housing, as shown in fig. 1 by dotted lines. The existence of the currents is revealed in the pitting of the bearing linings. The current in the path shown is produced by a pulsating flux linked with the

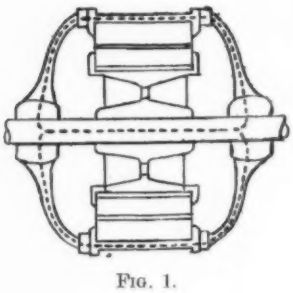


Fig. 1.

circuit, *i.e.*, a flux which embraces the shaft in a plane perpendicular to its axis, and pulsates as a flux-ring in the stator or rotor iron.

3. Dissymmetry.

The flux-ring occurs usually through dissymmetry, which may be—

(*a*) Dissymmetry in the windings.
(*b*) Dissymmetry in the cores.

(*a*) *Dissymmetry in the Windings.*—This occurs when the sum of the currents in the axial conductors in each direction are unequal, so that a preponderance of current in one axial direction results. For example, the several slip-ring connectors inside the rotor parallel to the shaft in rotary converters, induction motors, induction regulators, &c., are dangerous when the sum of the currents is not zero and when the conductors carry alternating current. (With induction motors this only occurs when starting, or running in cascade: with a short-circuited rotor the effect is small on account of the low rotor frequency.) The dissymmetry effect can take place also in generators when, in consequence of unbalanced loading and small damping, the exciting current pulsates with double line-frequency. Windings in which there is a connection at each end of the machine have an odd number of conductors, and therefore have a preponderance in one direction. Such sections of windings must be arranged in pairs, so that the excess in one section is neutralised by an equal and opposite excess in another section.

(*b*) *Dissymmetry in the Cores.*—In a two-pole machine (fig. 2*a*) the main flux has two paths, one on each side of the pole-centre line. The magnetic potential is the same for each of these paths, so that they carry the same flux if their magnetic reluctances are equal. In this case there is complete symmetry. If the reluctances of corresponding parts are unequal, however, the total flux will divide itself in inverse proportion to the reluctances; while in other parts of the magnetic circuit having equal reluctances, the distribution of flux will be symmetrical.

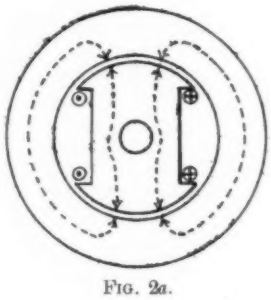


Fig. 2*a*.

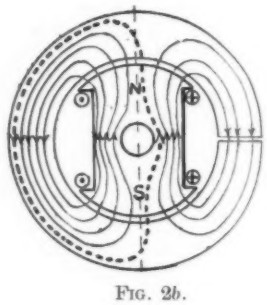


Fig. 2*b*.

Fig. 2*b* shows how a part of the flux is driven from one side of the stator in consequence of a joint, forming a flux-ring which revolves round the shaft as the polarity changes owing to the rotation of the magnet wheel. The flux-ring is always zero when the joint lies exactly on the pole-centre-line, and therefore pulsates at the fundamental frequency.

Now, there are often several such joints. Fig. 3 shows the formation of a flux-ring in a four-pole machine with two diametrical joints: this flux reverses its direction during the motion of a pole through a pole-pitch.

The effect is clearly the same when in place of the magnet wheel in figs. 2 and 3 there is the rotor of an induction motor, or when the stator carries the poles and the rotor is a jointed ring.

If, on the contrary, the magnet-wheel has joints, but the stator core has not, the flux-ring which is then produced rotates with the poles and the shaft, and preserves its direction relative to these; such a flux-ring cannot generate bearing currents. The *pulsating* flux-ring can thus only occur when the dissymmetry of the iron lies in that part of the machine with respect to which the main flux has relative motion.

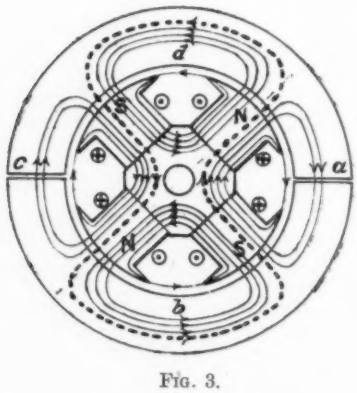


Fig. 3.

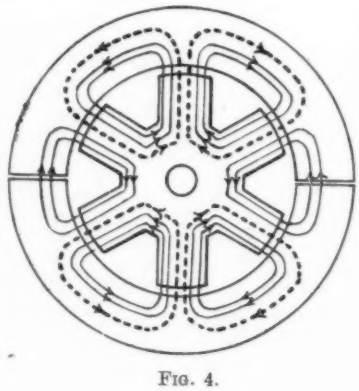


Fig. 4.

Now, joints do not necessarily lead to the generation of bearing currents. As an example, fig. 4 shows a 6-pole machine with two diametrical joints. Here the induction in the two-sixths of the stator ring in which the joints are situated is smaller than in the others. The dotted lines show the paths of the larger fluxes, which are closed outside the shaft. The difference between this and the 4-pole machine of fig. 3 consists in polarity in the 4-pole case, and in fields of opposite polarity in the 6-pole machine. This leads to the general statement. *The effects of two joints of unlike polarity on the shaft neutralise one another, the joints being separated by an odd number of pole-pitches.* It

is assumed that the magnetic resistances of the joints are equal.

To get an idea of the possible distribution of joints for any number of poles, we shall consider first the case of joints *symmetrically placed round the periphery*: they can be either lapped or plain butt joints. The former depend on the assembly of the laminations, which leaves only $\frac{1}{2}$, $\frac{1}{3}$ . . . of the total cross-section for the flux. Since the action is dependent on the ratio of the reluctance of the joint to that of the whole magnetic circuit, a wrong number of overlapped joints is also harmful, particularly in machines with small air-gaps (induction motors, commutator machines, &c.).

4. Rules for the Arrangement of Symmetrically-placed Joints.

With symmetrically-placed joints, the peripheral distance between any two consecutive joints is the same. The smallest possible number of symmetrical joints, lying alternately in fields of unlike polarity, is obtained when the distance between adjacent joints is the greatest odd number of pole-pitches by which the number of poles in the machine can be divided. The quotient of the number of poles ($2p$), and its greatest odd factor (f) determines the smallest group of equidistant joints (n_0) whose actions on the shaft neutralise each other. One can repeat this group as many times (x) as desired, the possible number of joints being then

$$n = xn_0 = x\,2p/f$$

where x is any integer.

Particular Cases: (*a*) If the number of *pole-pairs* is odd, then $f=p$. The smallest group of symmetrical joints is formed by two diametrical joints. Any even number of joints is possible.

(*b*) If the number of poles is a power of 2, *i.e.*, 2, 4, 8, 16, 32, . . . it is divisible by no odd number, except unity. The number of joints is therefore equal to the number of poles, or a multiple thereof.

Since the number of poles included in the latter group are often met with, they impose severe limitations on the subdivision of the laminations. For instance, an 8-pole machine with six segments and overlapping by half a segment is impracticable, since 12 joints are produced—two in one pole-pitch, one in the next, and so on. Thus all pole-pitches of the one polarity have twice as many joints as those of the other polarity. According to rule (*b*), only 8, 16 . . . joints should be used. If for reasons of economy of plates, eight segments cannot be used, a suitable construction can be obtained with six segments by lapping them $\frac{1}{4}$ instead of $\frac{1}{2}$, making 24 joints; this requires double the number of bolts. Particular regard must be given to machines for pole-changing, and when the same type is used for different numbers of poles.

5. Unsymmetrical Joints.

Joints for dividing cores are seldom lapped, simple butt-joints being mostly used. From the foregoing, it follows that one can only divide the iron into *two equal parts* when the number of pole-pairs is *odd*, and for an even number of pole-pairs the division would have to be unsymmetrical, one part having $p-1$, the other $p+1$ poles. The joints must have equal reluctances.

A division into four equal parts is only possible (1) when division into two equal parts is feasible, and (2) when half the number of pole-pairs is odd. In other cases the four parts are unequal—these may be similar pairs, or three of the parts may be alike and the fourth one different. For instance, to divide 32 poles into four parts, one can have two of $(8+y)$ and two of $(8-y)$ poles, where $y=1, 3, 5$ . . . or any odd number; or one can make the division 8.5, 8.5, 8.5, and 6.5 pole-pitches. Similarly for other cases.

6. Means for Suppressing Bearing Currents.

If it is not possible to provide the right number of joints through exigencies of construction, then means must be provided to prevent the flow of bearing currents. The most important method is the *insulation of the bearing from the bedplate and housing*. In machines with bolted-on end-shields, however, this presents difficulties. In this case the resistance between the shaft and the bearing should be reduced by a good conducting brush touching the shaft and fixed to the housing.

DUPLEX RADIO TELEPHONY.

Marconi "X" Series of Sets.

A recent radio telephone development of special interest to those who live in new and sparsely populated countries is the production of low-powered sets which are intended for the use of the general public wherever other means of rapid communication are not available. Simple in design and easily manipulated, they can be used by those possessing little or no technical knowledge, and they permit radio telephonic communication to be conducted on conversational lines; they should be, in fact, of value in any situation where the wired system is unavailable.

Two designs of duplex radio telephone sets, both of

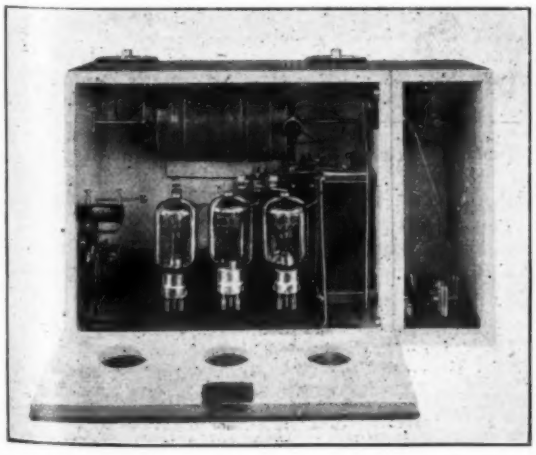


Fig. 1.—Duplex "Subscriber" Transmitter.

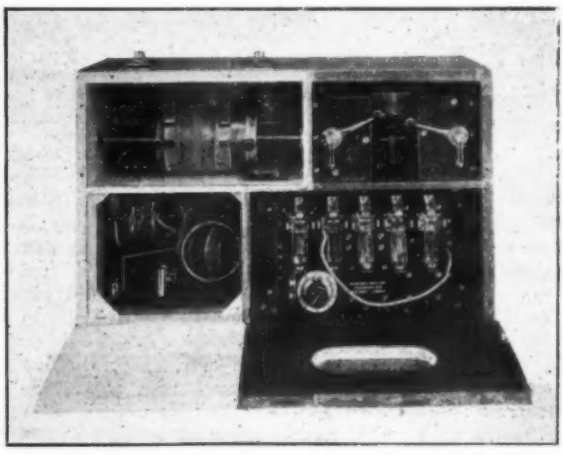


Fig. 2.—Duplex "Subscriber" Receiver

them suitable for domestic use, have recently been put on the market by Marconi's Wireless Telegraph Co., Ltd. One is known as the "Subscriber" set, type XA, and has a power of about 50 watts; the other is known as the "Popular" set, type XP, and has a power of about 5 watts. Apart from the differences in power, the two sets have certain distinctive characteristics in their practical application.

The "Subscriber" set (figs. 1 and 2) is so designed that, once installed, it needs no adjustment or tuning on the part of the user, who, in attempting to do so, might only succeed continually in putting his apparatus out of adjustment. The set, therefore, having been competently installed and adjusted, is locked up so that the adjusting apparatus is inaccessible to the subscriber. In order to render this scheme practicable, the circuits have been designed to give the utmost stability, even at a slight sacrifice of range, and extended trials carried out with a pair of these stations have proved that they can be left alone without attention for considerable periods.

The "Popular" set (figs. 3, 4 and 5), on the other hand, is designed so that the person operating it can easily adjust and tune his receiver within certain limits, and thus obtain the highest degree of sensitiveness. By this means, a useful working range is obtained with the use of very small power which enables the apparatus to be very much simplified. No running machinery is necessary with this set; in fact, the current required by the transmitting and receiving valve can be derived from a dry battery. The comparative simplicity and low price of this set will be appreciated, particularly in India and the Colonies.

The apparatus has been designed so that the adjusting devices can be manipulated by any person of average intelligence and, with the help of the instructions which accompany each set, it can be installed without expert assistance.

These two types of radio telephone set work on what is known as the "duplex" system—that is to say, transmission and reception can be carried on simultaneously at both stations exactly as in the case of ordinary land-line telephony. It has long been realised that the commercial application of this means of communication could be enormously extended once the difficulty of working in duplex had been overcome.

Interference between the transmitter and receiver in the Marconi Company's sets has been overcome in two ways: first, by separating the transmitting aerial from the receiving aerial and, secondly, by receiving on a different wave length to that radiated by the transmitter and by employing extremely selective receiving devices. The aerial system used with the sets is very simple; it consists of two masts—ordinary 30-ft. scaffold poles would be suitable—erected 200 ft. apart, between which is stretched a single wire of which about 20 ft. in the centre is electrically insulated, thereby dividing the wire into two aerials. From the inner ends of the aerials, connections are taken to the transmitting and receiving apparatus respectively. Thus, in effect, there are two separate aerials, one for the transmitter and the other for the receiver.

Even with two aerials, the set must be so designed that the transmitted speech waves do not cause interference in the local receiver and, to obviate such interference, the transmitter of one station always radiates a different wave length from that radiated by the distant station to which the local receiver is attuned. The transmitting and receiving circuits are therefore arranged to tune to waves of either 300 or 350 metres.

When the sets are required to work in pairs only, a simplified pattern is supplied in which the transmitter and receiver circuits of one set are definitely fixed at 300 and 350 metres, and of the other set at 350 and 300 metres respectively; thus, the receiver of one station is permanently attuned to the transmitter of the other and *vice versa*.

For group working, an ingenious arrangement has

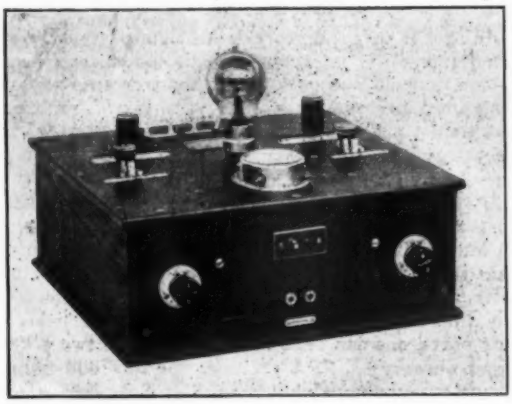


Fig. 3.—Duplex "Popular" Transmitter.

Fig. 4.—Duplex "Popular" Receiver.

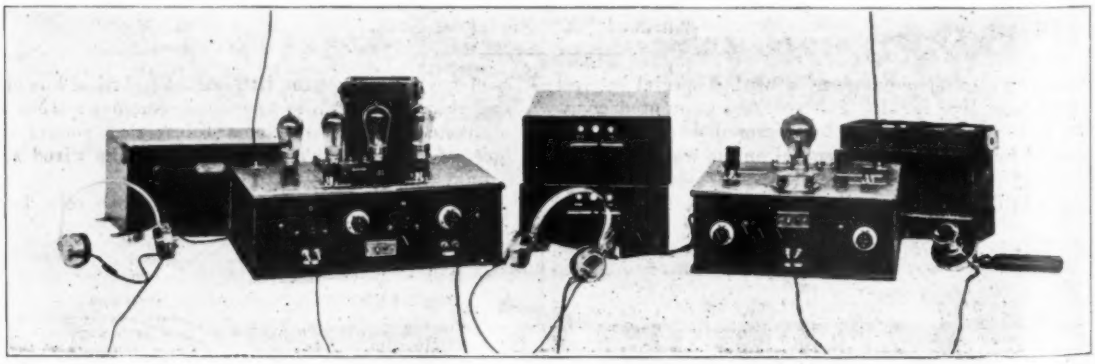


Fig. 5.—Complete Duplex "Popular" Installation.

been adopted to avoid the use of a multiplicity of different waves, which would necessitate each subscriber's being able to adjust his receiver to additional wave lengths, and the apparatus would become both complicated and extremely difficult to adjust. This difficulty has been entirely obviated in the design of the "Subscriber" set in the following manner: When supplied for group communication, each transmitter is equipped to transmit either of two waves, namely, 350 and 300 metres, and each receiver is equipped to receive either of these two waves. The change from one wave length to the other of both the transmitter and receiver is effected by relays which are so arranged that whenever the transmitter is switched on to the 350-metre wave, the receiver is automatically switched on to the 300-metre wave and *vice versa*. The whole change is accomplished by a single tumbler-switch which, when in one position marked "stand-by," adjusts the apparatus to transmit on 350 and to receive on 300, and in the other position marked "call," adjusts the transmitter to transmit on the 300 and the receiver to receive on the 350 metres wave length. All stations in the group normally keep their switches in the "stand-by" position, *i.e.*, with the receiver at 300 metres and the transmitter at 350 metres. When any one station wishes to call up another, the operator simply reverses the position of his switch, thus attuning his transmitter to the 300-metre wave to which all the other receivers are adjusted, and attuning his receiver to the 350-metre wave to which all the other transmitters are adjusted.

The receiver of the "Subscriber" set is provided with a five-valve h.f. semi-aperiodic amplifier. Before amplification, the received h.f. oscillations are converted from a 300 or 350-metre wave length to about 2,000 or 3,000 metres to obtain greater selectivity in the receiver as a whole, thereby preventing interference from the local transmitter. This conversion is accomplished by using a very small portion of the transmitted energy to heterodyne the received oscillations. Thus, with a station radiating on a 300-metre wave and receiving on a 350-metre wave, the frequency of the beats produced by superimposing the one on the other is about 143,000 cycles which, when rectified, produces a h.f. current corresponding to a wave length of about 2,200 metres.

In the smaller "Popular" duplex set, direct amplification of the received wave is effected by means of an amplifying filter circuit which, in conjunction with the aerial tuning circuit of the receiver, gives exceptional selectivity as well as efficient amplification.

The range of any radio telephone set is directly affected by many factors which vary considerably in different localities. However, under normal conditions such as obtain in England, a range of 45 miles could be obtained with the larger type XA set, while with the popular set, which is considerably smaller, a range of 20 miles could be obtained under similar conditions.

THE ELECTRICAL ENGINEERING INDUSTRY.

We published in our last issue a brief reference to the broadcasting talk by Mr. Hugo Hirst (chairman of the General Electric Co., Ltd.) on the electrical engineering industry. We are now able to give this interesting ten-minutes' review in full:—

I am requested by the Federation of British Industries to attempt the hopeless task of crowding into the short space of ten minutes my views on what the electrical industry is to-day, and what it is likely to become in days to come.

Some fifteen years ago the phrase, "Electricity is in its infancy," was abolished. It was said that when an industry employs hundreds of millions of capital, some hundreds of thousands of workpeople, when it lights our cities, drives our trams, cooks our food, warms our houses, and is beginning to be used for every kind of industrial and domestic purpose, it is no more in its infancy.

To-day I am more convinced than ever that electricity is still in its childhood. All the work we have done so far appears to me preparatory; fresh signals flash up in all directions and illuminate new roads which we have to pace.

First of all a few words on—

1. *Lighting.*—When speaking of lighting, we still think of lamps—why? Just as the first steam engine was a stage coach driven by steam, and the first motor-car was designed to look as near as possible like a private carriage, so it has happened with the lamp. It is the outcome of an evolution which has brought us from the candle and the oil lamp to the gas lamp, and from the gas lamp to the electric lamp. Standards and fittings to hold these older forms of lighting were in existence, and we still continue to adapt the old form to the new medium. But the world does not want lamps, it wants light, much more light. We want streets not lit with lamps that obstruct traffic, but supplied with a good substitute for daylight, for the safety of life and traffic. We aim at better-lighted shops to show the goods, but not to hide them behind glaring filaments which blind the eye. The electric lighting of vehicles, the lighting of houses, of theatres, of the stage, of picture galleries, of kinemas, of factories and churches, will all require individual study and development. Illuminating societies have been formed to solve this problem, big electrical firms have created illuminating departments manned by the best scientists, in order to develop these ideas, which are not purely an electrical problem. To light properly, say, a hoarding of posters or the front of a building, or the interiors referred to above, architects, builders, artists, and scientists will in due course have to collaborate to obtain the effect aimed at, namely, a substitute for daylight. It may affect the style and construction of our buildings, the colours and materials which we are using, and all kinds of questions not yet thought or dreamt of. After all, daylight is not a free gift, its cost is at times very heavy. Those who have built houses in cities and know what valuable space has to be sacrificed, and what complicated building plans have to be devised to ensure daylight, know that the cost at times is probably more than it would be for artificial light. All these effects can be achieved by electricity, not necessarily by lamp bulbs, it may be by tubes, it may be lighting by gases without filaments or many other ways which the visionary can conceive, but which are still to-day in the realm of investigation and research, and many years will elapse before a definite solution is reached.

2. *Electric Power.*—Equally revolutionary will be the development of power. We pride ourselves to-day on building 40,000-kW units for power stations that run our trains and trams and supply our factories, and it is encouraging to know that machines of this magnitude are being supplied by our manufacturers to-day, even to the United States, in spite of high tariffs and the strongest American competition. We pride ourselves on the application of electricity to every form of transport—that main pillar of civilisation. Even motor-cars and aeroplanes could not have developed as they did but for the magneto. We use electricity below the surface to crush ore and cut coal; by electric haulage we raise millions of tons to the surface, and electric pumps prevent the mine from being flooded. We pride ourselves on the progress made in many industries through the application of electricity, be it the textile industry, the engineering industry, or the steel industry. Electric current moves a 20,000-h.p. motor to roll a steel plate and hundreds of thousands of smaller motors to run tools of the most varied description, down to the domestic sewing machine or dentist's drill. But what is being done is a mere tithe of what could be done. Until every farmer can tap the electric current and sow, reap, thresh and cut, the task of the electrical engineer is not completed, and this, again, is not merely an electrical problem. In my opinion two factors are required to bring us to this ideal state—cheap production of power and cheaper electrical distribution. As regards cheaper distribution, my hopes are running very high. It is only a few years ago that Dr. Fleming invented the electric valve, and to-day already the British Post Office has realised that by inserting this valve in its circuits throughout the country, it can save from 70 to 80 per cent. in cables. See how this will eventually cheapen and improve the telephone service. What is to-day possible with small currents required for telephone service may conceivably in some way or other be possible some day in connection with big power plants.

As regards power, we pride ourselves on producing a unit at a farthing, and in some countries one-eighth of a penny, in certain big power installations, but it is produced by having steam, petrol, gas or water power as its prime mover. Some day it should be practicable to harness the tides on a large scale or to transform coal more economically into electricity, and some day we shall understand better how to use the enormous forces released by high explosives, or by some new mixture of gases. Some engines may be constructed of immensely greater horse power and efficiency. That would indeed cheapen electricity and make its service accessible to all, even the poorest.

Whilst some of these aims may seem visionary, we must

not forget that only quite recently that great British scientist—Professor Sir Joseph Thomson, of Cambridge—has revolutionised all our ideas regarding the universe by demonstrating that all matter consists of electrically-charged particles held together by extremely powerful electrical forces, and that under certain conditions this energy can be liberated. To do this, however, requires the application of electrical forces of very great intensity. This means that before we can hope to succeed in devising means of liberating this energy for use on a commercial scale, we must discover a method of producing really cheap power. True, in the present state of our knowledge this may seem a fantastic dream. But should it prove practicable, it might mean the artificial production and transmutation of the elements, including that dream of alchemists and magicians throughout the ages—the changing of lead into gold—in short, a new universe. And who, on looking back over the amazing discoveries of the last century, will dare to say that this will never come to pass?

3. *The Electric Home.*—But long before this period arrives, the electric home will be universal. After all, most problems of this kind are based on reciprocity. The electric home has been kept back because power is still dear, and it can equally be said that power is still dear because the electric home has not yet come.

I have lately read of an attempt to train domestic servants for their calling. I know of no better course for your servants wishing to be trained than a short engineering course to make them fit for the electric home.

Already to-day, the application of electric heating, cooking, driving of sewing machinery, washing machinery, and all sorts of domestic appliances has become widespread, but the time will come when, just as in the factory, all manual work is being replaced by electrically-driven machinery, so in the household all manual drudgery will be replaced by the turning of a switch.

All these small domestic apparatus, from the fan and flat-iron to the vacuum cleaner, consume but little current.

To-day there are millions of families in this country to be supplied, and the satisfaction of those demands would mean not only a prosperous electrical industry, from the point of view of the manufacturer of these different specialities, but in the aggregate it would create such a demand for electric current that all power stations would have to be increased. This would not only give an impetus to the development of heavy engineering in all its branches, but by leading to a decrease in the cost of the unit, would result in still greater development.

4. *Electric Railways.*—Time is too short to dwell on the fact that electric railways mean the possibility for thousands of people to live healthy lives in the country, away from the turmoil of factory and business town, that electric traffic alone can solve the problems of overcrowding in big cities, that by its means it will be possible to reduce the cost of carrying, and thereby the cost of living.

5. *Transmission of Speech.*—From the transport of men and goods by electricity we come to the transport of words and thoughts. The telegraph and telephone service throughout the world, with the exception, perhaps, of America, has been retarded in its development owing to the war, but here the same evolution from one process to another is taking place. Before the ideal system of automatic exchanges for big and small cities, for congested areas and sparsely-populated districts, is solved, I am certain wireless will step in, and all development will have to start afresh. All these improvements tend to quicken and cheapen communication; but they all require time for research, courage for enterprise, and time and capital for development.

You, who are listening-in to-night, are wireless experts. I need not tell you that there is no reason why, in a very few years' time, a King's Speech, an important debate in the House of Commons, a patriotic appeal, or a good opera, market quotations or sporting events, should not be simultaneously broadcast and heard in Australia, India, and all through the British Empire. Through electricity our hearts beat with one throb: we share, in spite of the distance, the same pleasures and the same sorrows, the same ideals and emotions simultaneously. Electricity, like nothing else, provides the means to knit together our far-flung Empire and to annihilate the handicap of distance between its various parts by shortening the distance of travel for men and goods, by transmitting quickly the thoughts of one part of the Empire to the homes of all by keeping those in the distant farms, in the bush, on the veldt, or in the mines of our overseas Dominions, in the closest possible touch with the centre and heart of the Empire.

6. *Support Home Industry.*—I hope that my few words have made it clear how electricity permeates every activity of our life, every industry and every home. Is it worth while that such an industry should be supported? I have been asked to address you this evening by the Federation of British Industries, of which I am a member. I have been asked to bring home to you that, without strong British industry, the material and moral forces of our Empire will suffer—with its help they will be strengthened. Every order that goes abroad strengthens the foreigner and weakens the home producer. Every article made abroad improves the skill of the foreign artisan and adds to unemployment at home. Every order going abroad cheapens the price of the foreign article and increases the price of the home-made article. Every order placed at home helps employment and helps industrial, social and political independence. Every order placed abroad leads to the deplorable dependency which we witnessed before the outbreak of the war, and but for which the war would have ended much sooner.

I think I have put in as subtle a manner as I can the duty before you, to do your share for the British industry; the British industry will do its share, not only for its own good, but for the good of the great British Commonwealth.

THE BROADCASTING COMMITTEE'S REPORT.

The report of the Broadcasting Committee that was appointed by the P.M.G. in April, 1923, to inquire into the radio telephone broadcasting scheme of the British Broadcasting Co., Ltd., has been issued.* The Committee's conclusions and recommendations may be briefly summarised as follows: Broadcasting has great potentialities and it will be in the public interest to encourage its development, under adequate control, and to facilitate its use for a wide variety of services. The existing scheme was successful in establishing a broadcasting service of considerable merit—which reflects great credit on the enterprise and ability of the British Broadcasting Co.—and partly successful in ensuring that the demand for receiving sets during the initial period should mainly benefit British manufacturers who had established the service. But the scheme has broken down in certain respects, largely owing to the unforeseen facility, cheapness, and popularity of the construction of home-made sets. The consequent difficulties cannot be overcome by any system of marking component parts either "B.B.C." or "British Manufacture."

The system of marking apparatus and deriving revenue for the broadcasting service from royalties on such apparatus gave the company a privileged position. The Committee has had no proof that it has made any improper use of it; but the system is open to objection from several points of view, and should be abandoned as soon as possible.

The Committee's recommended scheme provides: (i) That a Broadcasting Board should be established by statute to assist the Postmaster-General in the administration of broadcasting and to advise him on important questions concerning it; (ii) That the broadcasting service should not be operated by a Government Department, but that those entrusted with the service should work under Government licence; and (iii) That it is desirable that the operation of the existing service by the British Broadcasting Co. should be continued for a definite period, subject to agreed modifications in the company's licence, but that, subject to existing rights, the Government should keep its hands free to grant additional licences, and should consider various alternatives for the operation in the future, either by the company or by other authorities, of local or relay stations in addition to large stations.

With regard to financial provisions, the Committee states that no part of the cost of broadcasting should fall on the taxpayer, but the Government should not endeavour to make a profit on the administration of the service. The bulk of the revenue required for the service should be obtained from the receiving licence fee, which should be retained at 10s. a year, subject to consideration of a reduction in the event of more revenue being received than is sufficient to carry on an adequate service.

Instead of 5s. as much as 7s. 6d. out of the 10s. fee might be allocated under any new scheme to meet the cost of broadcasting, subject to a sliding scale under which the payment per licence would decrease as the number of licences increased. Certain supplementary sources of revenue should be the subject of early consideration

In place of the present broadcast and experimental receiving licences a uniform and simple type of licence should be issued and placed on sale at Post Offices without any formalities, containing a clause forbidding improper use of back-coupling on pain of withdrawal of the licence, but no other limitation on the apparatus allowed to be used. Effective measures should be taken to enforce such a licence, and certain additional statutory powers should be obtained to strengthen the Postmaster-General's hands.

The immediate application of the recommended scheme is most desirable, says the Committee, which also suggests that in consideration of the recommended modifications in the existing agreement between the British Broadcasting Co. and the Postmaster-General, the British Broadcasting Co. should be given an increased share of the receiving licence fees and a two years' extension of its own licence, on modified terms,

*Cmd. 1,951, H.M. Stationery Office. Price 9d. net.

if it will agree to the immediate application of the new scheme, and to certain alterations in its Articles of Association, but with retention of the limitation of dividends.

The Committee is unable to make any recommendation on the desire which has been expressed for the protection of the manufacturing industry against foreign competition, feeling that, although it was an object of the existing scheme, it must be left to be dealt with by Parliament as part of the fiscal policy of the country.

Concerning wave-lengths and hours of service, the Committee suggests that arrangements should be made for the greatest possible extension of the existing broadcast band of wave-lengths (350 to 425 metres), preferably by the allocation of a band from 300 to 500, excluding 440 to 460 metres; that all possible steps be taken to protect the band allocated to broadcasting from interference by other services; and that the present restriction of the hours of broadcasting be removed, thus enabling additional facilities to be provided.

The British Broadcasting Co. has achieved a large measure of success in gauging the public taste and providing satisfactory programmes. There should be a gradual extension of the broadcasting of news, under proper safeguards, and more latitude should be given for the broadcasting of special events without regard to the hour. The Postmaster-General should remain the final arbiter when any question is raised as to what kind of matter may or may not be broadcast.

Mr. J. C. W. Reith (representing the British Broadcasting Co.), Sir H. Norman, and Mr. C. Trevelyan, M.P., have signed the report with reservations.

The Postmaster-General has issued a statement on the report, an abstract of which follows:—

"Sir Laming Worthington-Evans finds that it is not possible for the scheme recommended by the Committee to be brought fully into operation immediately. It has been necessary to have regard to the existing agreement with the British Broadcasting Co., which does not expire until December 31st, 1924.

"In order to recognise the company's rights under its agreement, and at the same time to meet the views of the Committee as far as is immediately practicable, the Postmaster-General has agreed with the Broadcasting Co. that a constructor's licence should be issued for a limited period at an annual fee of 15s. (as compared with the fee of 10s. charged for the B.B.C. licence).

"The Company has agreed to this arrangement on condition that the licensee gives an undertaking that, in constructing his apparatus, he will not knowingly use parts manufactured elsewhere than in Great Britain or Northern Ireland. There are, however, probably 200,000 persons already in possession of unlicensed receiving apparatus. A special interim licence will be issued at a fee of 15s., covering their present apparatus, whether made or purchased, which will be granted to them provided that they apply for licences before October 15th. No charge will be made for past use, and no proceedings will be taken in respect of past use if the licence is taken out before October 15th.

"Constructors' and interim licences will be placed on sale at all head and branch post offices and certain sub-offices on and from October 4th. This system of licensing will be continued for an interim period expiring on December 31st, 1924, after which it will be possible for the single form of licence recommended by the Commitee to be introduced, without any condition as to the marking or origin of the licensed apparatus, if it should be then thought desirable.

"Out of the fees of 15s. for the constructor's licence and 10s. for the B.B.C. licence, the company will, if the House of Commons agrees, receive 12s. 6d. and 7s. 6d. respectively, instead of 5s. per licence which it receives under the existing scheme.

"The Postmaster-General stipulated for the continued payment of royalties on the sale of sets, but on a reduced scale. The reduction will be approximately 50 per cent., except in the case of crystal receiving sets, in which it will be considerably more. This reduction should enable a reduction to be made in the cost of receiving sets.

"The proportion of the licence fees receivable by the company will, after December 31st, 1924, be placed on a sliding scale based on the number of licences and the cost of maintaining an adequate broadcasting service. Any surplus profit accruing to the company will be surrendered to the Post Office.

"The existing experimental licence, at an annual fee of 10s., will continue to be issued from the General Post Office to persons who are able to satisfy the Postmaster-General that they desire the licence for *bona fide* experimental purposes and are qualified to conduct experiments, and who sign a declaration to the effect that they will not use the broadcast programmes except for experimental purposes.

"The basis of membership of the Broadcasting Co. will be extended to include dealers, with suitable representation on the board of directors for the new membership if it becomes at all substantial; and the deposit of £50 now required from members will be abolished. The licence held by the company will be prolonged, on suitable conditions, to the end of 1926.

"The Postmaster-General proposes at an early date to appoint an Advisory Board, as recommended by the Committee, to assist him in all important questions relating to broadcasting."

LEGAL.

Briggs v. Page & Kelsey.

In the Mayor's and City of London Court, before Judge Atherley-Jones, K.C., on September 26th, a claim was made by Mr. Joseph George Briggs, trading as G. Briggs & Co., electrical engineers, 53, Carnaby Street, Regent Street, against Messrs. Page & Kelsey, described as dealers in electrical appliances, 17, Peninsular House, Monument Street, E.C., for £54, the price of goods sold and delivered. Mr. T. F. Davis was counsel for the plaintiff, and Mr. Gallop represented the defendants.

Mr. Davis said that the amount of the claim was £61, but before the commencement of the present proceedings there had been a payment by the defendants of a sum of £7. It appeared that in April last the plaintiff and defendants were in negotiation regarding the terms of business in connection with the supply by the plaintiff to the defendants of radio receiving sets and equipment. Plaintiff contended that he had declined the offer made in the defendants' letters of proposal that they should act as agents, but had said that he would deal with them directly and not invoice the goods to their customers. The defendants contended that the goods in question had been ordered under a misunderstanding that they were to be sent for demonstration purposes. When they found that they were going to be charged for the amplifiers and valve sets they at once informed the plaintiff that they had no alternative but to return the goods, and this had been done, the goods so returned lying with the carriers pending the decision in that case.

The Judge, in his judgment, said that there was no evidence that the defendants were desirous of repudiating the contract entered into by reason of a falling market. The goods which were ordered by the defendants upon official orders were paid for, and the attitude taken up by the defendants was in confirmation of the documents upon which both parties were relying. Upon his interpretation of the documents he came to the conclusion that the goods were received by the defendants as agents and not as buyers. In those circumstances there would be judgment for the defendants, with costs.

Scottish Valuation Courts.

At Dundee, a local butcher appealed against the Assessor's valuation of £1 5s. for an electric mincing machine in his shop, and sought to have the charge removed. The Assessor stated that electric mincing machines in butchers' shops in the city had been placed on the valuation roll, and this practice had never been questioned until now. The point was raised following on a case which had been brought up in Glasgow. It had been decided that for this year the appeal should be withdrawn, but the agent for the Butchers' Association reserved the right to raise the question if thought necessary next year.

At Glasgow, Messrs. Wm. Beardmore & Co., Ltd., sought to have the valuation reduced from £6,169 to £1,000 in respect of a gun factory. It was claimed that the works in question was now merely a shell, and that the Assessor had sought to rope in the machinery. Machinery and appliances were no longer assessable, but the Assessor had taken the view that they were, with the result that large sums were included in the assessment for motors, &c., notwithstanding the fact that the motors were disconnected. The Court fixed the valuation at £2,500.

IMPORT TRADE OF CHINA.

The following table shows the value (and where possible the weight) of China's imports in 1922 of material of interest to the electrical and allied trades, indicating the principal countries of origin. The figures for 1921 are given in comparison, and notes of increases or decreases are added. It is probable that the trade credited to Hong-Kong was to a fair extent transacted with the United Kingdom.

The Haikwan tael=3s. 11½d. in 1921 and 3s. 9d. in 1922.

Country whence imported.	1921. Taels.	1922. Taels.	Inc or dec
Brass and yellow metal; bars, sheets, wire, &c.—			
Total	1,239,000	1,249,000	+ 10,000
Hong-Kong	483,000	544,000	+ 61,000
Great Britain	177,000	85,000	− 92,000
Japan	506,000	573,000	+ 67,000
Belgium	5,000	18,000	+ 13,000
United States	17,000	9,000	− 8,000
Russia	41,000	18,000	− 23,000
Copper, bars, rods, sheets, plates, nails, and wire.—			
Total	1,040,000	770,000	− 270,000
Hong-Kong	17,000	27,000	+ 10,000
Great Britain	165,000	193,000	+ 28,000
Japan	786,000	382,000	− 404,000
Germany	3,000	17,000	+ 14,000
Belgium	15,000	21,000	+ 6,000
United States	49,000	5,000	− 44,000

Country whence imported.	1921. Taels.	1922. Taels.	Inc or dec
Aluminium, manufactured.—			
Total	60,000	65,000	+ 5,000
Japan	40,000	29,000	− 11,000
United States	5,000	6,000	+ 1,000
Germany	4,000	16,000	+ 12,000
Machine belting.—			
Total	1,085,000	1,181,000	+ 96,000
Hong-Kong	87,000	100,000	+ 13,000
Great Britain	302,000	431,000	+ 129,000
Japan	298,000	241,000	− 57,000
United States	337,000	423,000	+ 86,000
Russia	70,000	2,000	− 68,000
Germany	1,000	10,000	− 9,000
Electrical materials and fittings.—			
Total	13,204,000	9,403,000	−3,801,000
Hong-Kong	496,000	593,000	+ 97,000
Great Britain	3,418,000	2,852,000	− 566,000
Italy	114,000	36,000	− 78,000
Japan	3,140,000	2,769,000	− 371,000
Canada	378,000	44,000	− 334,000
United States	4,658,000	1,698,000	−2,960,000
Sweden	112,000	95,000	− 17,000
Belgium	260,000	295,000	+ 35,000
Holland	81,000	200,000	+ 119,000
France	72,000	55,000	− 17,000
Machine tools.—			
Total	931,000	634,000	− 297,000
Great Britain	296,000	86,000	− 210,000
Denmark	7,000	21,000	+ 14,000
Japan	293,000	154,000	− 139,000
Canada	7,000	3,000	− 4,000
United States	271,000	82,000	− 189,000
Germany	34,000	204,000	+ 170,000
Propelling machinery, such as boilers, turbines, &c.—			
Total	5,109,000	2,395,000	−2,714,000
Great Britain	3,351,000	1,506,000	−1,845,000
Japan	255,000	218,000	− 37,000
Canada	53,000	13,000	− 40,000
United States	998,000	318,000	− 680,000
Sweden	44,000	18,000	− 26,000
Germany	115,000	286,000	+ 171,000
Belgium	281,000	8,000	− 273,000
Machinery, other, not textile, brewing, refining, &c.—			
Total	21,000,000	15,583,000	−5,417,000
Hong-Kong	960,000	842,000	− 118,000
Great Britain	6,459,000	5,568,000	− 891,000
Japan	2,396,000	1,850,000	− 546,000
Canada	528,000	77,000	− 451,000
United States	7,516,000	3,174,000	−4,342,000
Sweden	322,000	1,484,000	+1,162,000
Germany	681,000	1,711,000	+1,030,000
Belgium	346,000	534,000	+ 188,000
France	129,000	80,000	− 49,000
Russia	205,000	106,000	− 99,000
Telegraph and telephone material.—			
Total	1,641,000	1,507,000	− 134,000
Hong-Kong	45,000	46,000	+ 1,000
Great Britain	367,000	524,000	+ 157,000
Japan	322,000	395,000	+ 73,000
Canada	40,000	20,000	− 20,000
United States	297,000	97,000	− 200,000
Sweden	171,000	137,000	− 34,000
Germany	143,000	233,000	+ 90,000
Belgium	225,000	44,000	− 181,000
Scientific instruments and apparatus.—			
Total	1,047,000	879,000	− 168,000
Hong-Kong	79,000	79,000	—
Great Britain	201,000	159,000	− 42,000
Germany	122,000	212,000	+ 90,000
Belgium	12,000	7,000	− 5,000
France	21,000	17,000	− 4,000
Japan	266,000	239,000	− 27,000
United States	343,000	173,000	− 170,000

CORRESPONDENCE.

Letters received by us **after 5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

What is Electricity?

We are capable of comprehending a duality, matter and motion; the former in many forms, presumably different arrangements of a uniform atom and in any conceivable degree of density or attenuation from platinum to ether (why the last-named should ever have been supposed to be other than matter I fail to see); the latter also in many forms, *e.g.*, momentum, heat, light, electricity and others. Why expect a definition of a form of motion in terms of matter? What is heat? A thermal unit is an arbitrary measure as is a foot-pound or a volt-ampere, but neither has weight or substance to anyone except a fanatical monist who must have everything brought down or up to a materialistic concept. I hope others will support Mr. Yerbury in doubting the dogmatic assurance that matter is electricity. No one has yet seen, weighed, or located the atom or even the molecule, so probably the nucleus which we now hear so much about is only another name for the atom and the condition of the said atom, *viz.*, its electrical state is mistaken for a coating of lumps of electricity sticking to its surface. As I said above, there are several known forms of motion. No doubt there are as many or more remaining unknown. I believe it will shortly be recognised that life is one of them. If a chemist could compose with sufficient accuracy the ingredients of protozoa, each ingredient with its appropriate and unavoidable attribute in the shape of some known or unknown form of motion, the resultant would be a living cell. I suppose this is what Prof. Schaeffer did, or thought he did, a few years ago. Was he sufficiently accurate, or perhaps only lucky? It will, of course, be objected that life, unlike the known forms of motion, ceases at death, but surely this may be only apparent. All known forms of motion are transmutable indefinitely, without "mechanical" or "artificial" assistance. A body strikes an immovable obstruction, and its momentum becomes heat. Heat imprisoned in vacuo becomes light. Light impeded by an opaque obstruction becomes partly heat and partly other things; or rather modes of motion, under certain circumstances, electricity and possibly life, or, at any rate, the last of a train of necessaries to generate life.

September 24th, 1923. **R. T.**

Price Reductions?

As a consumer both of the Wimbledon Corporation and the County of London Electric Supply Co., Ltd., I was very interested in Mr. Wallis's letter, *re* price reductions, published in a recent copy of your journal.

To the former undertaking I pay 6d. and 1d. per unit, while the County of London Co. charges me 8d. and 2½d. for the same thing, and I, for one, would gladly see these exorbitant figures reduced.

If the County of London Co. were in bad circumstances one might understand these high charges, but I see in another page of the REVIEW that it pays an excellent dividend to its ordinary shareholders, and that the ordinary £1 share can be purchased for £2 2s. 6d.! And this is a public supply company!

Surely this is a question that should be taken up by the competent authorities. Why are not electricity supply companies governed by the same rules as gas companies, in which the dividend payable is controlled by the price of the gas, i.e., the higher the dividend the lower the price?

Another detail of interest: I have to pay 3s. to the County of London Co. and 1s. 6d. a quarter to Wimbledon for their respective meters, which both carry out the same duties. Is there any explanation for this super charge as well? Surely the answer is not Barking! If so, I do not quite see why all the County of London Co.'s consumers should be penalised till the elephant, at present colourless, has arrived.

September 25th, 1923. **J. Hendra.**

Further to my letter of mid-August, the price of electricity in Wimbledon is down to 5½d. per unit and the County of London Co. has not suggested a reduction! and is still charging 8d.

I note your remarks *re* statutory limit, but surely, when a public supply company can pay 12 per cent. to its shareholders, who can sell their pound shares for £2 3s. 1½d., something ought to be done to revise this statutory limit.

Are the consumers of the City of London Co., the Charing Cross Co., &c., satisfied with their charges? Personally I feel there is a need for a "Society for the Prevention of Extortion by Public Electricity Supply Companies."

I forward the following statistics culled from your journal in support of the above suggestion:—

From June, 1922, to September, 1923, the ordinary shares of the undermentioned companies increased as shown:—

County of London £1, from £1 5s. to £2 3s. 1½d.
City of London £1, from £1 18s. 9d. to £2 9s. 4½d.
Kensington Ordinary £5, from £7 2s. 6d. to £9 17s. 6d.
Charing Cross £5, from £6 17s. 6d. to £12.
Chelsea £5, from £5 12s. 6d. to £8 15s.
London Electric £3, from £2 1s. 3d. to £4 12s. 6d.
St. James & Pall Mall £5, from £8 7s. 6d. to £11 15s.

I feel you must agree with me that these figures clearly show that there is something radically wrong somewhere.

Only last month the results obtained by another London station were referred to as comparable with those of Wimbledon, these results being far superior to those obtained at Wimbledon; and the other London station charges 1s. per unit, being run by a company, while Wimbledon is quite satisfied with 5½d.

Again, I ask: are all the consumers taking current from the above supply companies satisfied with their charges?

T. S. Wallis, A.M.I.E.E., &c.

Wimbledon, *October 1st*, 1923.

HOPEFUL CANADIAN OUTLOOK.

A hopeful view of Canadian trade conditions is expressed in the report* by H.M. Trade Commissioners at Toronto and Vancouver (Mr. F. W. Field and Mr. L. B. Beale) which has just been issued by the Department of Overseas Trade. Last year, it is pointed out, was one of readjustment. The industrial position has been strengthened by elimination of weak factors and by consolidation. Further adjustment will have to take place, but in the Commissioners' view the prospects for a general and gradual improvement are excellent. Whilst the demand for goods is likely to improve, the buying as a rule will be, for the most part, for short periods ahead.

With regard to Great Britain's share in future Canadian trade, the Trade Commissioners are equally hopeful. Mr. Field again urges that there is a strong desire in the Dominion to purchase British goods, but he emphasises the fact that there is keen competition from local and United States manufacturers, and a great need to study the market and organise proper local representation; nothing, he remarks, equals in value the visit of a capable member or representative of a firm. The result of such a visit usually is that the firm definitely and correctly decides either to enter the market or stay out. In the former case it does business in a manner which will secure results in a country that is governed by conditions which operate as a group in no other market.

Importance of "Service."

Mr. Field states that what is popularly known across the Atlantic as "service" dominates the Canadian market to a high degree, and he contrasts American methods with British, somewhat to the disadvantage of the latter. The agent of a competing firm will be given all possible help by his principals; his telegrams are answered by telegrams when necessary; his suggestions are carefully considered; his complaints have a sympathetic ear. On the other hand, there is found too often a local agent of the United Kingdom firm who is given little support. His telegrams receive a belated reply by letter; his suggestions are ignored; his correspondence is unanswered; his complaints fall upon deaf ears.

While Mr. Field softens his criticism by adding that such shortcomings apply only to a percentage of British firms, he says they are sufficiently numerous to prove that too many British manufacturers have little or no conception of the hard work required to sell British goods in the Dominion. The maintenance of stocks as widely as possible is advocated, and the employment of a competent advertising agency.

Mr. Beale, writing about conditions in British Columbia, points out that much of the raw material and engineering supplies used in local industries comes from the United Kingdom, but American firms, by establishing branch factories or distributing warehouses in Canada, have an advantage in many lines. The latter feature, in his opinion, might well be followed by many British manufacturers.

Encouragement of Industry.

Mr. Field calls attention to the three outstanding features of the changes in the Customs tariff and laws which came into effect on May 12th, 1923. They are the reduction of many rates in the British preferential tariff, the encouragement of new Canadian industries and traffic through Canadian ports, and the opportunity afforded the United States to foster closer trade relations with the Dominion. The more important tariff rates were given in the Electrical Review of August 31st.

The requirement that British goods, in order to secure the 10 per cent. discount off the tariff rate, should be brought direct to Canadian ports, is expected materially to develop the business of these ports. It is especially noteworthy that access all the year round can be had to Victoria and Vancouver. British shippers to those ports can generally obtain a more favourable freight rate that the American consignor from the manufacturing centres of the United States.

In connection with the system of bounties by means of which the Canadian Government encourages its budding industries, the position with regard to the production of copper bars and rods is of interest to the electrical engineer. Although Canada is rich in copper resources the industry has made only moderate progress. Encouraged by a duty of 1½ cents per lb. on copper in the form of ingots, a large enterprise was established some years ago in British Columbia. Copper bars and rods, being the raw material of wire manufacturers, were some time ago placed on the free list for the use of Canadian manufacturers in their own factories. Bars and rods have not been produced in Canada because of the inability to compete with large manufacturing concerns in the United States. The Canadian Government believes that the best form of assistance it can give to the industry is a bounty for a period of five years. It will begin at 1½ cents per lb. and diminish from year to year until the end of the five-year term. The privilege granted to manufacturers to import copper rods and bars for their purposes free of duty will continue.

In addition to the encouragement of Canadian industries by bounties, favourable Customs treatment is granted to machinery of a kind not made in Canada, designed to manufacture goods not made in Canada. This machinery does not come in free, but is given a drawback which makes it pay practically only 40 per cent. of the ordinary duty.

*Department of Overseas Trade, 2s. 6d.

Anti-Trust Legislation.

The report mentions the way in which it is proposed to watch the operations of combines. The text of the Prime Minister's resolution on which is to be based a Bill to provide for the investigation of combines, monopolies, trusts, and mergers, contains provisions of power to remit or reduce duties or revoke patent rights where combines are proved to exist, and also for the imposition of penalties for violation of the proposed legislation. Six persons, British subjects, must lay complaint. Investigatory proceedings by a commission will be *in camera*, but the power of publicity may be invoked should the Commissioner deem it advisable.

Engineering Standards.

On the question of engineering standards the report refers to the activities of the Canadian Association, which is carrying out work similar to that of the British Engineering Standards Association. It does not propose to undertake the duty of a testing authority in determining whether or not a given product complies with its conditions. Such duties should be (and, Mr. Field adds, it is hoped will be) performed in Canada by an Official Standards Laboratory as part of its regular work. The Association is at present drafting standard specifications for incandescent lamps and wattmeters. It has already issued them for distribution-type transformers and galvanised telegraph and telephone wire.

"White Coal" and other Fuel.

It is a little surprising in view of Canada's wealth of minerals generally and her vast resources of "white coal" that she should have recently been importing increasing quantities of coal from Great Britain. Mr. Field quotes the Deputy Minister of Mines as saying that Canada's principal fuel problem is to find a substitute for United States anthracite coal for domestic use. If certain obstacles are overcome it is considered that Ontario and Quebec would prove good markets for British coal.

In reviewing the steady progress of water-power development in Canada Mr. Field records that the total hydraulic installation reached last year about 3,000,000 h.p., of which 240,000 h.p. was installed during the year.

Future prospects, it is pointed out, are for pronounced activity. Installations now under construction or actively projected will have a total capacity of nearly 1,000,000 h.p., the construction naturally being spread over several years. At the Queenston station of the Ontario Hydro-Electric Power Commission the installation, which is at present 220,000 h.p., will probably be doubled. The Quebec Development Co. has begun preliminary work on the Saguenay River for a 350,000 h.p. development and the 125,000 h.p. plant at Le Gres Falls on the St. Maurice River is under construction.

Huge Hydro-Electric Projects.

In Mr. Field's opinion the present year bids fair to be one of the most active in hydro-electric work in Quebec Province. Three major new projects are to be started within easy transmission distance of Montreal and Quebec, and two others will undoubtedly be developed in the near future. The project at Lake St. John calls for the development of 600,000 h.p., of which a considerable proportion will be installed immediately.

Another interesting development is taking place at the Grand Metis Falls; the Lower St. Lawrence Power Co. is erecting a power house with an ultimate capacity of 10,000 h.p., to supply the immediate needs of Rimouski, Matane and the surrounding area.

The Southern Canada Power Co. finds it necessary to install its second development on the St. Francis River. A new plant which will be started this autumn will be erected at Hemmings Falls, of a capacity of 30,000 h.p.

The Montreal Light, Heat, and Power Co. is completing the Cedar Rapids plant on the St. Lawrence River. Orders have been placed for 60,000 h.p. in four units. Two of these were to be installed during the summer of 1923 and two of them next summer.

In addition, the development of the Carillon Falls on the Ottawa River (200,000 h.p.), and the development of Back River, a 40,000-h.p. enterprise to the north of the Island of Montreal, appear to be certain in a relatively short time.

It is not only in the factories but also in the homes and on the farms that the use of hydro-electric power is increasing in Ontario. As an indication of the rapid growth of the residential consumption of electrical energy, the prevalence of electric cooking at the end of the year may be cited. In seventeen of the principal cities and towns of Ontario there is an average of one electric range for every six residential consumers, and in 20 of the municipalities over 18,500 electric cooking ranges are in use. Most of these ranges have been installed recently. Their popularity is due to the low net rate of 0.9 cent per kWh which prevails in most of the large municipalities for cooking. In the past year rates in the smaller and more distant municipalities have been revised, so

that now the highest rate for cooking is only 1.8 cents per kWh. It is expected that this will result in a much greater demand for electrical energy for use in cooking than has been experienced in the past.

Distribution Extensions.

In view of the enormous additions which are thus being made to the supplies of power, the demand for all kinds of electrical equipment, large and small, is likely to grow in proportion. At the same time the report calls attention to the fact that increased consumption in many Ontario municipalities has commenced to place a serious burden upon the local distribution systems. The capacity of the latter will accordingly have to be increased, necessitating the purchase of line material, transformers, and other equipment.

That British firms have keen competition to meet from Canadian and United States firms is well known. It will not, however, be overlooked that in connection with the Winnipeg plant three United Kingdom firms made bids which compared favourably with those of their competitors, and that the contract was awarded to a Glasgow firm.

Western Canadian Developments.

Mr. Beale gives, in his section of the report, an interesting review of the progress in the production of electrical energy in Western Canada. The construction of the new power plant at Great Falls, Manitoba, for the Manitoba Power Co., is proceeding satisfactorily. The first milestone in the completion of this 168,000-h.p. development was passed on December 28th, 1922, when the initial unit of 28,000 h.p. was placed in operation under partial head. This event was the culmination of a year of remarkable constructional achievement in which the programme, as planned by the company, was carried out in every respect. Several other large schemes are in hand.

In recording the successful re-organisation of the Manitoba Government telephones Mr. Beale draws attention to the gratifying fact that a large portion of the new automatic exchange equipment is being installed by a British firm.

BUSINESS NOTES.

Bankruptcy Proceedings.—David Wm. Hogan, 3, Leonard Place, Kensington, W.—The first meeting of creditors was held on September 28th at the London Bankruptcy Court under the failure of this debtor, who had acted as managing director of the Allies Electric Lamp Repairing Co. The receiving order was made on September 12th upon the petition of a moneylending creditor. Mr. F. T. Garton, Official Receiver, reported that it appeared from the debtor's statements that in 1914 he was acting as manager of the business carried on by the above-mentioned company, and he continued in that capacity until 1919, when he acquired the whole of the shares in the company for £5,000, which he borrowed from friends. He was appointed managing director of the company but the business since 1919 had not been a success, and although he had made protracted efforts to sell he had been unable to do so. In December, 1921, the debenture holder appointed a receiver and the debtor was actively engaged in helping him financially and otherwise until his death, which took place two months ago. The whole of the company's effects were still on its premises at Hammersmith. His liabilities, which he roughly estimated at £4,000, were almost entirely in respect of cash borrowed for, and guarantees given on behalf of the company. His assets consisted of his interest under his father's will, and this he had charged to his solicitor for £250, while he also possessed a debenture for £5,000 in the company in respect of costs incurred. There was no surplus value attached to this. The debtor attributed his present position to the want of success of the company. It was submitted on behalf of the debtor that, if the meeting were adjourned, he hoped to be able to put forward an offer for the consideration of the creditors. No resolution was passed and the chairman closed the meeting with the intimation that the debtor could submit his offer to the Registrar when the application for an order of adjudication came before him.

G. M. Hallett, electrical engineer, 7, King's Street, Frome.—Trustee, Mr. J. P. Emett, 18, Nicholas Street, Bristol, released September 17th.

A. J. Barlow (Barlow Bros.), electrical and general engineer, 9, Brunswick Place, City Road, E.C.—Last day for proofs for dividend, October 12th; trustee, Mr. A. Willmott, 14, Old Jewry Chambers, E.C.

D. H. Griffin (Midland Electric Co.), electrical engineer, 5, The Mart, St. David's Road South, St. Annes-on-Sea.—Last day for proofs for dividend, October 16th; trustee, Mr. H. Parker, Official Receiver, 11, Winckley Square, Preston.

T. S. Cartwright (T. S. Cartwright & Co.), electrical contractor, 90, Wellington Street, Stockport.—Last day for proofs for dividend, October 13th; trustee, Mr. J. G. Gibson, Official Receiver, Byrom Street, Manchester.

Company Liquidations.—British Industries Fair (Birmingham), Inc.—Winding up voluntarily. Liquidator, Mr. G. H. Wright, 95, New Street, Birmingham, who is authorised, after satisfaction of all debts and liabilities of the Association, to transfer to the Birmingham Chamber of Commerce (Incorp.) all the remaining property of the Association. Meeting of creditors October 8th, at 95, New Street, Birmingham. (All creditors have been or will be paid in full.)

Connolly Bros., Ltd.—First dividend of 12s. 6d. in the £, payable October 8th, at 2, Moorgate Buildings, E.C.

Indicators, Ltd.—A petition for the winding up of this company has been presented to the High Court by Messrs. Johnson & Phillips, Ltd., 12, Union Court, Old Broad Street, E.C., creditors, and will be heard in London on October 16th.

Wireless Installations, Ltd.—A petition for the winding up of the company has been presented to the High Court by Rotax Motor Accessories, Ltd., of Rotax Works, Willesden Junction, N.W., and will be heard in London on October 16th.

Home Radio & Electric Co., Ltd.—Winding up voluntarily. Liquidator, Mr. J. H. Reed, 71, Kingsway, W.C.

Yorkshire and District Electric Lamp Repairing Co., Ltd.—Winding up voluntarily. Liquidator, Mr. H. Cawood, 68, Eyre Street, Sheffield. Messrs. H. J. M. Cokayne, A. S. Lee, and V. B. Vickers are appointed a committee to fix the liquidator's remuneration and to advise the liquidator on any matters connected with the winding-up.

Star Electrical Accessories, Ltd.—A meeting of members is called for November 3rd at 55, Temple Row, Birmingham, to hear an account of the winding-up from the liquidator, Mr. H. J. Gittings.

Catalogues and Lists.—The Automatic Coil Winder and Electrical Equipment Co., Ltd., Wellington House, Buckingham Gate, S.W.1.—An illustrated booklet describing the "Macadie" coil winder and the "Avometer" combination electrical instrument for measuring voltage, current, and resistance. Also a mailing card (priced) dealing with the latter.

The Mullard Radio Valve Co., Ltd., 45, Nightingale Lane, Balham, S.W.12.—List MW1, containing an illustrated description of the "Wecovalve" (dull emitter type) and accessories. Priced.

Western Electric Co., Ltd., Connaught House, Aldwych, W.C.2.—Two illustrated and priced booklets dealing respectively with loud speakers and "Wecohomy" wireless sets, components, and accessories.

Sterling Telephone and Electric Co., Ltd., 210-212, Tottenham Court Road, W.1.—Publications Nos. 365 and 373, dealing respectively with the "Sterling" "baby" loud speaker and radio-telephone components generally. Illustrated and priced.

Messrs. Best & Lloyd, Ltd., Cambray Works, Handsworth, Birmingham.—An illustrated and priced catalogue of electric fires of varied design.

The British Rawhide Belting Co., Ltd., Hythe Road, Willesden, N.W.10.—A price list and an illustrated leaflet relating to the firm's belting, packing, pinions, &c.

Hart Accumulator Co., Ltd., Stratford, E.15.—A priced and illustrated pamphlet advertising accumulators for radio work.

Ideal Commutator Dresser Co., 5,353-5,361, N. Western Avenue, Chicago, Ill., U.S.A.—Illustrated folders dealing with commutator re-surfacers of various patterns.

Messrs. Watson & Sons (Electro-Medical), Ltd., Sunic House, Parker Street, Kingsway, W.C.2.—A pamphlet explaining the firm's scheme of insurance for X-ray tubes.

Zenith Manufacturing Co., Villiers Road, Willesden Green, N.W.2.—An illustrated and priced catalogue of resistances of many patterns.

Cryselco, Ltd., Kempston Works, Bedford.—An illustrated list giving reduced prices of "Cryselco" lamps.

Messrs. Donovan & Co., 47, Cornwall Street, Birmingham.—An illustrated and priced sheet advertising test-room rheostats.

Messrs. Groggon & Co., Ltd., 16, Upper Thames Street, E.C.4.—An illustrated and priced card advertising the "Welco" bowl fire.

Trade Announcements.—Messrs. Boorne & Co., of 126, Deansgate, have been appointed Manchester agents to the Vincent Switchgear Mfg. Co., and they hold stocks of Vincent products.

The London Electric Firm, of Croydon, has just purchased from the Jeary Electrical Co., Ltd., of 8, Lamb's Conduit Hill, E.C., the remaining stock of "Braulik" winches, contact devices, arc lamps, transformers, and spare parts, &c.

To deal with increase in business and to give improved local service, the Brush Electrical Engineering Co., Ltd., of Loughborough, has opened offices at Sheffield and Birmingham. The Sheffield office is under the management of Mr. C. E. Brotherton, at 32, White Building, Fitzalan Square. (Telephone No.: 5277; telegrams: "Turbine" Sheffield.) The Birmingham office is under the management of Mr. Malcolm Brown at Phœnix Chambers, Colmore Row. (Telephone No.: 5799; telegrams: "Colbree" Birmingham.)

Mr. T. D. D. Geesin, 4, Clevedon Road, Penge, S.E.20, has been appointed representative for London and district by Murex, Ltd., ironfounders, Rainham, Essex.

Messrs. A. H. Hunt, Ltd., have appointed Mr. Ratcliffe to represent their interests for their own products and the "Hellesen" batteries in the West Riding of Yorks and Lancashire. Mr. Ratcliffe has long been connected with the electrical trade in this area. He is an old Metropolitan-Vickers man.

Messrs. James Cook & Sons, who have commenced business as electrical engineers, &c., at 126, Aldersgate Street, London, E.C.1, desire to receive catalogues and lists.

We are asked to state that Mr. Robert Archer George Read, trading under the name of Read & Partners, at 115, Baker Street, West, whose death recently occurred, had no connection with Mr. Herbert James Read, the managing director of Read & Partners, Ltd., electrical engineers, of 53, Victoria Street, S.W.1, and of Reading. Messrs. Read and Partners, Ltd., state that they have no connection with any other firm of the same name.

Catalogues Wanted in the West Indies.—H.M. Trade Commissioner in the British West Indies (Mr. J. L. Wilson Goode) wishes to receive for purposes of reference and display in his office, copies of up-to-date catalogues of British productions, in order that he may be in a better position to further British trade in the West Indies. They should be addressed to him at 10, Broadway (P.O. Box 225), Port of Spain, Trinidad. Trade catalogues and advertising matter of no commercial value are admitted free of duty.

Book Notices.—"Armoured Switchgear" is the title of a brochure just issued by Messrs. A. Reyrolle & Co., Ltd., of Hebburn-on-Tyne, containing reprints of our article of January 12th, 1923, describing a visit to the company's works, and articles in other journals. The whole gives a very complete review of the factory and its products, chief of which is the purely British armour-clad compound-filled type of switchgear which was developed by this company.

The first issue of "Experimental Wireless," published this week, contains a number of articles on matters of special interest to the serious experimenter, to the exclusion of broadcasting news and items that would appeal only to the amateur who wants to make a simple receiving set. The new journal is therefore welcome as filling a gap in the literature of a fascinating branch of electrical science. The October issue comprises 56 pages, and is well illustrated, whilst the articles are of high technical value. The journal is published by Messrs. Percival Marshall & Co., price 1s. net (monthly).

"Junior Magnetism and Electricity," by R. H. Jude and J. Satterly (second edition). Pp. viii+288; figs. 171. London: University Tutorial Press. Price 4s.

"Science Abstracts (Sections A. and B.). Vol. XXVI; Part 9. No. 309. September 25th, 1923. London: E. and F. N. Spon, Ltd. Price 3s. each.

"The Poulsen Arc Generator," by C. F. Elwell. Pp. 192; figs. 149. London: Ernest Benn, Ltd. (Benn Bros.). Price 18s. net.

"The Structure of the Atom," by N. R. Campbell. Pp. x+161; figs. 6. London: Cambridge University Press. Price 10s. net.

Municipal Workers' Protest.—On September 29th a demonstration was organised by the National Federation of General Workers to protest against the lengthening of the working week, and the reduction of wages, proposed by certain Metropolitan borough councils. The demonstrators were advised, by Messrs. Ben Tillett, M.P., and J. O'Grady, M.P., not to strike, but to combine and use their votes to counteract the Councils' ufove.

A New "Cosmos" Showcard.—The Metropolitan-Vickers Electrical Co., Ltd., has produced a new showcard advertising its "Cosmos" radiophones. The main feature of the card is a fine water-colour drawing depicting female figures dancing to music provided by a satyr and adjoining this are representations of "Cosmos" cabinet and box receiving sets.

The British Industries Fair (Birmingham).—We have received a copy of the prospectus of the Birmingham section of the Fair, which is to be held from May 12th to 23rd, 1924. The change of date to a more favourable part of the year is calculated to improve the prospects of the success of the affair, and already many of the exhibitors at last year's Fair have applied for increased space. To enable small firms, or firms who do not wish to make a large display, to participate, the Council has decided to make available a number of complete stands, 6 ft. deep with an 8-ft. frontage. The exhibits will be divided into the following classes:—Brassfoundry, hardware, and ironmongery; metals; construction, building, and decoration; power, lighting, heating, cooking, and ventilating; engineering; agriculture; mining; motors, motor cycles, cycles, &c.; guns, saddlery, &c.; brewing, distilling, and catering; and services. Most of these classes offer scope for electrical exhibitors.

It is to be understood that the liquidation which is mentioned in another column of these notes will in no way affect the holding of the 1924 Fair.

New Municipal Showrooms.—The Hackney Electricity Committee has accepted an offer of premises in Lower Clapton Road, E., suitable for showrooms, offices, &c. The Finance Committee recommends the borrowing of £5,000 to defray the cost.

The Canadian National Exhibition.—The electrical and allied industries were very well represented in the Canadian National Exhibition, which closed on September 8th. The *Electrical News* (Toronto) publishes a list of 70 firms which participated in the display, and among them are several English electrical firms, as well as a number of American concerns. The *News* takes an optimistic view and states that far more interest was shown in electrical goods than has been the case previously, and the prospects of business as a result of the exhibition are very bright. Our contemporary, however, is not satisfied that the electrical industry took full advantage of the opportunity; several branches were not represented, and the effect was somewhat diminished on account of the distribution of the electrical stands instead of their being arranged in one large group.

Another Petters Success.—We are informed by Messrs. Petters, Ltd., Yeovil, that at the Mandalay Agricultural Exhibition and Conference (the most important exhibition of its kind in Burma), which closed on August 25th, they were awarded the Silver Medal and Certificate (highest award) for the exhibit of their oil engines. The exhibit included a range of engines of the medium compression cold-starting type.

A G.E.C. Lighting "Campaign."—In common with the other national suppliers of "lighting service," the General Electric Co., Ltd., has organised a publicity campaign in preparation for the winter.

It has been the regular practice of the company to group its advertising matter about a central object. The "Osram" elephant and hornbill (with its punning reminder of an unpleasant subject) are already familiar to the public. This time a pretty but precocious child, by Mr. Septimus Scott, is the central figure. The picture is employed in various ways,

The "Osram" Baby.

on posters, blotters, and other devices. Accompanying this note is an illustration of a shop-window centre piece which displays the design in an effective way.

A special catalogue has been produced. This is really a work of art having an attractive cover and water-colour illustrations upon a special paper. Among other things issued in connection with the scheme is a metal-faced cut-out for shop windows. In addition to the above there are numerous new pamphlets, including one entitled "The Passing of the Pip," dealing with the manufacture of "pipless" lamps, and faintly reminiscent of Browning.

New Belgian Companies.—The Société Téléphonie Automatique T.S.F. is a company formed at Liége, with a capital of 200,000 fr., for the manufacture, sale and installation of telephone and telegraphic apparatus of all kinds.

The Société Anonyme Centrales Electriques (80, Rue du Nord, Brussels) has raised its capital to 2,706,800 fr.

New Schedules of Standard Traffic Charges.—The Mansion House Association on Railway and Canal Traffic for the United Kingdom has prepared for the guidance of its members a specimen form for the lodging of objections with the Railway Rates Tribunal against the new schedules of standard charges. It will also co-ordinate all objections sent through the Association.

Unemployment.—The number of persons on September 24th recorded on the live registers of the employment exchanges in Great Britain was 1,232,000. This was 3,847 more than in the preceding week and 253,878 less than the figure recorded on January 1st, 1923. The total included 918,700 men, 44,300 boys, 228,100 women, and 40,900 girls. In addition, the number working systematic short time and drawing benefit for intervals of unemployment was 74,800 on September 24th, as compared with 74,724 on September 17th, and 56,261 on January 1st, 1923.—*The Times.*

Tennis Handicap.—On September 29th, Mr. W. R. Rawlings attended a meeting of the Rawcester Athletic Association (Messrs. Rawlings Bros., Ltd., and Rawlplug, Ltd.) for the purpose of presenting gold badges, racquets, and blazers to the successful competitors in the "sealed handicap," which is to be held annually. Afterwards eight of the unsuccessful competitors took part in a "knock-out" tournament. Membership of the Club is open to friends as well as employés of the companies.

Applications for British Trade Marks.—The following are among the recent applications for British trade marks. Objections may be entered against any of the proposed marks within one month from the dates mentioned. In the case of foreign applications, the names and addresses of the British representatives are also given.

Kyljack. No. 439,127. Class 1. Insulating coverings and compositions. The Graphite Oils Co., Ltd., Immingham Docks, Lincs. September 26th, 1923.

Bi-durite. No. 429,988. Class 8. Insulated electric cables. The British Insulated & Helsby Cables, Ltd., Helsby, near Warrington. September 26th, 1923.

Priorphone. No. 436,953. Electrical apparatus in Class 8. Walter H. Collins, trading as W. H. Collins & Co., Excelda Works, Rookery Road, Handsworth, Birmingham. September 26th, 1923.

Harmony, Beauty, Clarity (lettering and design). No. 437,859. Class 8. Wireless telephonic receiving sets, accessories, &c. Letitia Butcher, trading as the Gramophone Manufacturing Co., 92, Tottenham Court Road, London, W. September 26th, 1923.

Magnet. No. 421,385. Class 8. Accumulators, batteries, dry cells, cables, resistances, parts of telephones, &c. No. 421,386. Class 11. Accumulators, batteries, medical lamps, &c. The General Electric Co., Ltd., Magnet House, Kingsway London, W.C. September 26th, 1923.

Zaza. No. 439,745. Class 13. Electric lamps (ordinary). The Metropolitan Lighting Co., Ltd., 25, Atlantic Road, Brixton, S.W. September 26th, 1923.

Flasolite. No. 440,315. Class 13. Electric lamps (ordinary). The Naamlooze Venootschap Philips' Gloeilampenfabriek, Eindhoven, Holland. (Boult, Wade & Tennant, 112, Hatton Garden, London, E.C.) September 26th, 1923.

Trisotherm (lettering and design). No. 439,365. Class 18. Electric stoves, fires and other heating apparatus. John C. Campbell Macdonagh, 226, Portsdown Road, London, W.9. September 26th, 1923.

Pontelec. No. 439,428. Class 18. Electric welding plant. Buckley, Saunders & Co., Ltd., 8, Princes Street, Westminster, S.W. September 26th, 1923.

Celeron. No. 437,597. Class 50. Laminated materials formed by impregnating paper or fabric with phenol and formaldehyde, the said materials being for electric insulating purposes. The Diamond State Fibre Co., Bridgeport, Penn., U.S.A. (Johnson & Willcox, 47, Lincoln's Inn Fields, London, W.C.) September 26th, 1923.

Coalite.—According to the *Financial Times*, it is reported by Low Temperature Carbonisation, Ltd., that the greatly increased demand for Coalite smokeless fuel has necessitated the plant at Barugh, near Barnsley, being enlarged to produce 3,000 tons per week. Arrangements are also being made to erect additional plant in other coal-producing centres.

State Assistance in Czecho-Slovakia.—By the law passed in July to assist electricity undertakings with public money, by the remission of Custom dues, &c., a sum of 44,100,000 Czech-kronen is placed to the credit of 16 concerns out of 23 now in hand or projected. Besides this assistance, provinces and districts are ready to advance capital to a total of 131,219,000 kr., while private capital to the extent of 62,048,000 kr. will be subscribed to carry out 10 schemes.

Austrian Railway Contract.—It is stated that the A.E.G. Union and the Austrian Siemens-Schuckertwerke have obtained the contract for the electrification of the Vienna municipal railway.

The Boilermakers' Lockout.—As mentioned in our last issue, the Shipbuilding Employers' Federation met the Federation of Engineering & Shipbuilding Trades at Carlisle on September 28th. The Member of Parliament for Sunderland (Mr. Luke Thompson) had sent a letter to both sides asking for a definite declaration as to whether or not the boilermakers were bound by the overtime and night-shift agreement arrived at between the employers and employés in March last; and also whether the employers would give an undertaking to consider any special circumstances peculiar to the boilermakers' trade. The result of the conference took the form of a reply to this letter by the employers. This stated that the Boilermakers' Society was not expelled from the Federation of Engineering and Shipbuilding Trades until May 17th, and that, therefore, the Society was a party to and bound by the agreement. In reply to the second part of Mr. Thompson's letter, the employers intimated their willingness to give special attention to any circumstances peculiar to the boilermakers' trade.

The Boilermakers' Society is calling a national delegate conference and the question is also being considered by the General Council of the Trade Union Congress.

Customs Formalities Throughout the Empire.—In the course of its third report on Inter-Imperial Trade, the Federation of British Industries brings forward the desirability of establishing uniformity of practice throughout the Empire in all Customs formalities and similar matters. In this connection the Federation has recently forwarded recommendations to the Government with regard to the agenda for the international conference, which is to meet this month, under the auspices of the League of Nations, and it therein refers to the equitable treatment of commerce as regards Customs formalities and similar matters. The Federation is aware that the Dominion Governments, as members of the League of Nations, will take their part in this Conference, but it feels that it is desirable that in so far as the matters to be dealt with there affect inter-Imperial trade they should be discussed at the Imperial Economic Conference, in view of the particular advantages of obtaining uniformity of practice among the different parts of the Empire. The Federation therefore confirms the recommendations which it has made and specifically recalls various points to the attention of the Government in this third report.

Swedish Electrical Industry.—*Swedish Export* for August, a paper published by the General Export Association of Sweden, contains a reprint of an article on "Swedish Electrical Industry," tracing its origin in 1840 and its development down to date. The writer concludes as follows:

"After the conclusion of peace the favourable state of business wavered for the first time in 1919, after which there was an upward trend for a short time. Bad times began in earnest at the close of 1920, and since then they have been permanent, on the whole, though not without hope of some improvement during the present year. The losses suffered by the Swedish electrical industry during the past few years, caused by deflation in combination with home and foreign competition, run to no less than about 35 per cent. of its aggregate share capital, and consequently represent a serious bleeding of its funds. A fairly general writing down of the share capital has therefore become indispensable, and has already, for that matter, been carried out by some firms. At the present moment leading electrical firms in Sweden represent an aggregate share capital of about 140,000,000 kr. During the years 1891-1900 home production showed a comparatively slow rise in the struggle against imports, which for several years were of the same order of magnitude as home manufactures. In the decade immediately preceding the world war the home industry was stabilised, with a comparatively powerful growth in output values; but it was not until 1912 that the exports exceeded the imports. But this favourable turn was of short duration, for the year in which peace was concluded, when the ports of the country were again opened to unimpeded import, a fact which substantially contributed to make worse the economic crisis that was inevitable at that point of time, was marked by a considerable excess of imports over exports in the department of electrical manufactures. The years immediately following the close of the world war may be regarded as the worst in the modern economic life of Sweden. During those years the profits which had been reaped during the war were practically completely swept away by unchecked imports from countries with a weak currency, and widespread unemployment ensued. It was only natural that the electrical industry should share the evil days that fell on Swedish industry as a whole. It would seem, however, that the most critical phase has now been passed, and there are good hopes of a development in an upward direction."

Russian Orders in England?—According to a Russian newspaper, a group of English industrialists will shortly arrive in Moscow for the purpose of finally clearing up the question of the orders received by them for the construction of some turbo-generators of a capacity of 16,000 kW. Two of the generators are to be erected at the Shatur station and another at the Kashir station, or that of the Electro-Transmission works.

The Lodz Central Station.—The Electric Lighting Company of 1886, of Petrograd, also owns a central station in Lodz, Poland, and with the consent of the Polish Ministry of Trade and Industry an extraordinary general meeting of the company has been convened, to be held in Warsaw on October 11th, to consider the question of the conversion of the Lodz undertaking into a Polish concern. Negotiations have been proceeding with the Polish authorities for some time past on the matter, and it is assumed that it will be possible to get the Polish undertaking liberated from compulsory administration and converted into an independent Polish company.

The Economic Conference.—We have received a copy of the memorandum prepared for the Imperial Economic Conference by the British Empire Producers' Organisation on Empire preferences, the development of Empire resources, and the necessity for continuity of the work of the Conference.

Commercial Secretary for Chile.—The Department of Overseas Trade announces that it has been decided to re-establish the post of Commercial Secretary for Chile. Mr. W. F. Vaughan Scott, lately Commercial Secretary for Czecho-Slovakia, has been appointed to the position. Mr. Vaughan Scott, who formerly held the post, leaves for Santiago on October 11th.

Unemployed Engineers on the Clyde.—The Glasgow correspondent of *The Times Trade Supplement* states that when Lord Weir, head of G. and J. Weir, Ltd., sailed for America the other day he stated quite frankly that he was going as an ordinary commercial traveller for the purpose of drumming up orders. He could not get in this country enough employment for his firm's works, and so he was going to see what could be done on the other side of the Atlantic. Messrs. Weir specialise in auxiliary machinery of all kinds for ships, and their trade is feeling very seriously the great depression in shipbuilding. They are not alone, however, in looking abroad for work to carry them over this period of exceptional difficulty. All the firms which make main propelling machinery and do not construct ships are competing strongly for Continental orders, and in quite a number of cases they have been successful. In consequence machinery has been made on the Clyde recently for a vessel built in Norway, while there are under construction in the Glasgow area engines for one large motor ship and five small steamers, all of which are being built in Holland. Glasgow firms are also providing machinery for a vessel which is being built for owners in the East, while there is always a fair trade in the export to British Dominions of small steam and motor propelling sets for vessels built by non-engineering firms. The work now on hand in the engineering shops of the district is only a small fraction of what would be required to give employment to all the idle men, and all the foreign contracts that can be obtained will make hardly any appreciable difference in the number of unemployed engineers. Nothing but a pronounced revival in shipbuilding will bring about an improvement. At present short time is being resorted to more and more in marine engineering and auxiliary shops, and in boilermaking.

For Sale.—Southampton Corporation Electricity Department has for disposal one 900-i.h.p. Pollit & Wigzell horizontal cross-compound engine, complete with jet condenser direct coupled to a 500-kW Dick-Kerr d.c. generator. Messrs. Chalmers, Wade & Co., 5, Fenwick Street, Liverpool, have for sale as a going concern the business of Messrs. James Scott, Ltd. (in liquidation), marine and general electrical contractors, of Bootle and Port Dundee and branches. (See our advertisement pages to-day.)

LIGHTING AND POWER NOTES.

Abergele. — Electricity Order. — The Urban District Council has applied to the Electricity Commissioners for an Order authorising it to supply electricity in the district.

Accrington.—New Plant.—The Electricity Committee is negotiating with Messrs. Babcock & Wilcox for the installation of coal-handling plant at the electricity works. Borrowing powers for the scheme have already been sanctioned.

Adwick-le-Street (Yorks.).—Proposed Electricity Scheme. —The Urban District Council has received a report from its consulting engineer on the proposed scheme for lighting the districts of Adwick, Carcroft, Woodlands, Skellow and Highfields by electricity, and has decided to apply to the Electricity Commissioners for the necessary powers to carry out the scheme. The Brosworth Colliery Co. has offered to give a bulk supply of electricity, the Council to bear the cost of mains.

Ammanford.—Purchase of Undertaking.—The Urban District Council has decided to purchase the local electricity undertaking from Mr. W. Herbert, at a cost of £17,375.

Australia.—Liverpool (N.S.W.).—At a meeting of the Town Council a scheme to provide electric light and power for the town was considered. The scheme, which was unanimously adopted, involves an expenditure of £16,000.

Ballarat and Bendigo (Victoria).—The Electric Supply Company, of Victoria, has decided to install in each city two 1,000-kW steam-driven turbo-alternators, which are being imported from England. The estimated cost of the new plant is £70,000.—*Reuter's Trade Service* (Melbourne).

Bristol.—Year's Working.—The annual report of the chief engineer of the electricity undertaking (Mr. H. Faraday Proctor) for the year ended March 31st last records a total income of £337,228; a working expenditure totalling £202,427; and a gross profit of £134,801. The equivalent figures for the previous year were: Income, £345,139; expenditure, £238,324; and gross profit, £106,815. The net profit, before transferring any amount to the reserve for renewals fund, was £58,316, as compared with £31,925 in the preceding year. Of this surplus £46,330 was transferred to reserve, and £7,319 used for capital purposes.

The capital account shows an expenditure of £183,947 during the year. The principal items composing this amount were: Machinery, £62,796; mains, £85,225; and Colston Avenue offices, £13,840. The amount of energy sold increased from 37,079,702 kWh to 43,116,425 kWh. Both the plant capacity (27,650 kVA) and the maximum load (19,800 kVA) showed an increase of about 4,000 kVA. The load factor fell slightly—from 28.60 to 27.59 per cent. The report says that another 4,000-kW single-phase machine, and a 7,000-kW three-phase machine are nearing completion. Twenty-eight miles of additional cable was laid during the year, and 20 new sub-stations were constructed and equipped. Mention is made of the use of the Mangnall-Irving thrust borer in the laying of cables beneath public roads, thus avoiding the disturbance of traffic.

Burnley.—Linking-up Scheme.—A deputation from the Corporation has interviewed Accrington Corporation regarding a proposal to proceed during the coming winter with the laying of an electricity main between the two towns, in accordance with the scheme arranged by the Electricity Commissioners for the Mid-Lancashire Electricity District. The Corporation now awaits a reply to its inquiry as to the price at which Accrington will be prepared to supply it with electricity at the Hapton-Huncoat boundary.

Cambridge.—Proposed Purchase of Undertaking.—The General Purposes Committee has recommended that a special committee be appointed to consider and report to the Council as to whether it is desirable that the Corporation shall exercise on December 13th, 1924, the option of purchasing the undertaking of the Cambridge Electric Supply Co., Ltd.

Chesterfield.—Loan Sanctioned.—The Town Council has received sanction to a loan of £500 for wiring small houses for electric light, and to £292 for cable extensions to Newbold Village.

Continental.—Czecho-Slovakia.—The building of the great dam on the River Thaya, part of the scheme for harnessing that river for the generation of electricity, has secured official sanction. The works will cost 520,000,000 Czech kronen and will take from five to six years to complete.

Spain.—A concession has recently been granted by the Spanish Government for the establishment of a plant to utilise the water power of the River Villefria, near Respende de la Peña (Province of Palencia), in the generation of electrical energy for lighting and power purposes.

Finland.—A long report is published in a Helsingfors newspaper regarding the progress of the work in connection with the proposed erection of a large hydro-electric works at the Imatra Falls. The report shows that the progress so far made only applies to excavation works, the erection of a dam, &c. Surveys have already been made for the construction of the overhead transmission lines, along which it is proposed to transmit current at a pressure of 110,000 volts as far as the west of Finland.

Derby.—Mains Extensions.—The Electricity Committee has decided to extend the electricity mains, at a cost of £2,658, and has applied to the Unemployment Grants Committee for financial assistance.

East Lothian.—Electricity Supply.—The application of the Lothians Electric Power Co. for permission to supply electricity within the burghs of Cockenzie and Port Seton, Haddington, Prestonpans and Tranent has been sanctioned by the East Lothian Western District Committee.

Fleetwood.—Electricity in Bulk.—The electrical engineer has been instructed to prepare a report on the proposal to give a bulk supply of electricity to the Preesall Urban District Council.

Helston. — Proposed Electricity Supply. — The Town Council has received an offer of an electricity supply for the district from the Cornwall Electric Power Co., and has referred the matter to a committee for consideration.

Ilford.—Electricity in Bulk.—The Urban District Council has decided, subject to a satisfactory agreement being entered into, and subject to the approval of the Electricity Commissioners, that the linking up with West Ham for a bulk supply of electricity be agreed to.

India.—Ahmedabad.—According to the *Times Trade and Engineering Supplement*, the Ahmedabad Electricity Co. has decided to extend its plant. The present plant consists of five Mirrlees-Diesel-Crompton generating sets, with a total capacity of 810 kW, and it is intended to install three more 750-b.h.p. Mirrlees-Diesel engines, each coupled to a British Thomson-Houston 500-kW generator, bringing the total output of the station to 2,310 kW.

Irish Free State.—Dundalk.—The formal opening of the extensions to the electricity works took place on September 27th, Mr. F. McGee, chairman of the Electricity Committee, setting the new plant in motion. A new Vickers-Petters 500-h.p. oil engine, direct coupled to a Metropolitan-Vickers 340-kW dynamo has been installed. The first extensions, costing £21,000, were necessitated by an agreement of 1914, to supply the whole of the locomotive works of the Great Northern Railway Co. (Ireland). Further additions were made in 1922, and provision made for future extensions at a cost of £14,000. The complete plant now comprises six oil engines, with a total output of 1,080 kW. The extensions have been carried out to the plans and specifications of the engineer and

manager of the undertaking (Mr. Percy A. Spalding). The capital expenditure on the undertaking is now nearly £70,000.

Macroom (Co. Cork).—Owing to labour disputes in the county the local electric lighting company has had to temporarily close down its plant, as the coal supply is exhausted and the supply of electricity for public and private lighting has been discontinued.

Llandudno.—Electricity Agreement.—The Urban District Council has arranged terms with the North Wales Power Co. for a supply of electricity in bulk. The charge is to be at the rate of 8s. 4d. per kW per month, plus ¾d. per kWh for all electricity supplied. The Council is to pay in addition during the year ending August, 1921, a sum not exceeding £1,400, in respect of the cost of the transmission line from the sub-station at Colwyn Bay to Llandudno.

London.—Hackney.—*Year's Working.*—The accounts of the borough electricity undertaking (engineer: Mr. L. L. Robinson) for the year ended March 31st last show a total income of £157,081, as compared with £168,763 in the previous year. The working expenditure amounted to £70,413, as against £87,564, leaving a gross profit of £86,668 (£81,199). Although the capital charges were rather higher than those of the preceding year the net profit increased from £32,733 to £34,133. In addition to this there was a profit of £52 on the sales department. The balance was disposed of as follows: Capital expenditure defrayed from revenue, £11,317; contributed to relief of rates, £20,835; transferred to reserve, £2,033. The capital account shows an expenditure of £120,446, machinery and plant representing £75,308; mains and services £23,615; and buildings £14,733. The report states that the sales increased from 17,426,605 kWh to 18,582,376 kWh. The maximum load increased from 11,273 kW to 11,594 kW, and the load factor improved from 17.65 to 18.29 per cent.

"Free" Wiring.—The Electricity Committee recommends the continuance of the "free" wiring system for a further period. A sum of £5,000 was granted for this purpose in 1922, and it is now desired to borrow £10,000. The cost of the installations is recouped by a small additional charge per kWh, the rates being 8d. for lighting and 1½d. for heating and cooking.

Maidstone.—New Plant.—The Electricity Committee has recommended to the Town Council that a new 3,000-kW generating set, with accessories and two water-tube boilers, be installed at the electricity works at an estimated cost of £47,000.

Morecambe.—Loan Sanctioned.—At a recent meeting of the Town Council the Town Clerk reported that the Electricity Commissioners had sanctioned the borrowing of £20,000 on account of the application for £43,000 in connection with the new electricity scheme for the area of Lancaster, Morecambe, and Heysham.

Newark.—Electricity Scheme.—The question of the special needs of Newark in relation to electricity supply came under consideration when the inquiry was held by the Electricity Commissioners at Nottingham some months ago with regard to the general scheme for the supply in the East Midlands, and the matter again came up for discussion at a recent meeting of the Town Council, when the responsible committee reported that it had considered Mr. Wordingham's report on all sources of supply, and recommended that it would be most advantageous to have a local generating station belonging to the Corporation, and that the town clerk should communicate with the Electricity Commissioners asking them to approve of the local scheme submitted last March. The committee's report was adopted.

New Zealand.—Hydro-electric Development.—In a report to the Christchurch (New Zealand) City Council, Messrs. Charles B. Hawley & Co., of Washington, give details of the proposed hydro-electric development of the Waimakariri River at Otarama Gorge, near Christchurch. The scheme would cost £838,600, and would provide an initial generating capacity of 15,000 kW, with an increase to 22,500 kW by the installation of additional equipment, and an ultimate capacity of 45,500 kW.—*Reuter's Trade Service* (Melbcurne).

Preston.—New Power Station.—The Corporation has received the sanction of the Electricity Commissioners to the borrowing of £138,900 for the erection of a new generating station. Sanction to borrow £74,826 for mains, &c., has been withheld for the present.

Price Reductions.—Reductions in the charges for electricity have been made in the following districts:—

Reigate.—Heating and power, 2½d. per kWh.

Haslingden.—Lighting: From 7¾d. to 6d. per kWh. Heating: From 2½d. to 1½d. per kWh.

Hebden Bridge.—Lighting: From 7d. to 6½d. per kWh. Heating and cooking: From 7d. to 6½d. per kWh. Domestic rate: From 2d. to 1½d. per kWh. Power: From 3½d. to 3d. per kWh. Street lighting: From 4d. to 3½d. per kWh.

West Ham.—Lighting: Ordinary meters, 5d. per kWh; prepayment meters, 6d. per kWh. Power: First 40 kWh per h.p. installed per quarter, 3½d. per kWh, beyond 1½d. Heating and cooking, 1½d. per kWh. Factory lighting, up to 10 per cent. of quarterly power consumption, or 15 per cent. of monthly power consumption, 3½d. per kWh. Theatres, kinemas, &c., 3½d. per kWh. Traction: First 6½ million kWh, 1.3d., beyond .9d.

Special Orders.—The Electricity Commissioners have submitted to the Ministry of Transport for confirmation Special Orders authorising the North Somerset Electric Supply Co., Ltd., to supply electricity within parts of the rural districts of Axbridge and Long Ashton, and Major B. J. Day and Lt.-Col. C. B. Bartley to supply electricity within the Rural District of Cranbrook.

Stainland.—Electricity Supply.—At a recent meeting of the Urban District Council it was reported that the Electricity Commissioners had decided to grant the application of the Electrical Distribution of Yorkshire, Ltd., to supply electricity to the district.

Ware.—Electricity Charges.—The Rural Council has decided to offer no objection to the application of the North Metropolitan Electric Power Supply Co., for power to increase its charge for electricity to 8d. per kWh.

York.—Loan Sanctioned.—The Town Council has received the sanction of the Electricity Commissioners to a loan of £10,000 for mains and £3,336 for the provision of converter plant. Providing there is a sufficient number of consumers guaranteed, the mains are to be extended to the village of Copmanthorpe.

TRAMWAY AND RAILWAY NOTES.

Bolton.—New Routes.—The Town Council is extending the Brownlow Fold tramway along Elgin Street and Church Street, and is to proceed with the laying of the portion of the track to Westhoughton, which is within the borough.

Continental.—Switzerland.—The National Council has voted a credit of 60,000,000 fr. for the immediate electrification of the Federal railways.—*Reuter* (Berne).

Spain.—Application has recently been made to the Government for a concession to construct electric railways between Granada and Zubia and between Chauchina and Fuente Vaqueros.

Liverpool.—Fares Revision.—The Tramways Committee has abolished the 3d. through fares, for which 2d. fares will be substituted, and extended the penny stages to a distance of approximately two miles. It is stated that the tramway fares are now the cheapest in the Kingdom, as it is possible, under the revised scale, to travel from the pierhead to Garston, a distance of 6½ miles, for twopence.

Manchester.—Proposed Electric Railway.—According to the *Daily Dispatch*, in view of the Prime Minister's statement that he will be prepared to consider schemes for providing employment, it has been decided to submit the scheme for the proposed Manchester & District Electric Railway for the consideration of the Government. The scheme comprises an underground section and a surface section, with a total length of 32 miles. The city terminus of the former would be located in the northern part of the town and a twin tube line would run southwards under the city to Withington, and from there a branch line would be constructed from Stretford Road to Trafford Park. From the tube station at Barlow Moor Road a surface railway would continue to Chelford, and from the station at Trafford Park a line would be constructed to Lymm. Underground stations would be built at Derby Street, Corporation Street, Piccadilly (Central City Station), Lower Mosley Street, Stretford Road, Alexandra Park, and Old Trafford, while stations on the surface lines would be at Barton Bridge, Davyhulme, Irlam Ferry, Carrington, Partington, Warburton, Heatley, and Lymm. For the present it is proposed to limit the application for financial assistance to the cost of constructing the central underground city section, eight miles in length, plus four miles of surface railway. The estimated cost of this part of the scheme, including stations, lifts, electrical equipment and rolling stock, is £2,500,000. It is intended to open negotiations with the Manchester Corporation for the supply of the whole of the power for operating the railway. Conferences of Westminster and Manchester engineers have been held, and it is desired to obtain the support of the Corporation before approaching the Government for financial assistance.

Railless Cars.—The Tramways Committee recommends the City Council to make application to Parliament for powers to operate railless cars along the routes within the city where tramways have already been authorised but not constructed.

Newcastle-on-Tyne.—Unemployment Relief Schemes.—The Transport and Electricity Committee has a number of schemes in hand for providing work for the unemployed during the winter months. It is proposed to construct light railways from Slatyford to Westerhope village and from Slatyford to Denton Burn. Extensions are to be made to the Westgate Road and Benwell Lane routes, and the relaying of the track on the Great North Road from Newcastle to Gosforth village is being proceeded with.

Southampton.—Scheme Abandoned.—On the recommendation of the Tramways and Works Joint Committee the Town Council has decided not to proceed this autumn with the promotion of a Bill for extending the tramways.

TELEGRAPH & TELEPHONE NOTES.

Sweden.—New Telephone Cable.—The work of laying the large telephone cable between Stockholm and Gothenburg, which was commenced in February, 1921, has now been definitely achieved. The whole cost has not amounted to the estimated sum of Kr.20,000,000.—*Reuter's Trade Service* (Stockholm).

Irish Free State.—Telephone Service.—A large modern auxiliary switchboard has recently been installed in the Central Telephone Exchange, Dublin. It cost about £8,000, and will, it is claimed, enable an operator to deal with 50 per cent. more calls with less exertion than when operating the old board. The new board is capable of serving 2,000 subscribers. Considerable improvement has been effected in long-distance calls. Occasional calls are now made from Dublin to Paris with quite satisfactory results, while progress has been made recently in Dublin and suburbs and other large areas throughout the country in laying underground cables to replace overhead wires.—*Irish Independent.*

RADIO NOTES.

Australia.—Radio Regulations.—Regulations governing the issue of licences for broadcasting under the Wireless Telegraph Act, which were recently approved by the Federal Executive Council, have been tabled in the House of Representatives. The following fees will be payable annually for licences: Broadcasting station, £15; coast, ship, and land stations, dealers' experimental (transmitting and receiving), portable and aircraft stations, £1; experimental (receiving only), 10s. For a broadcast receiving station a licence will be issued on payment of 10s., together with the annual subscription payable to the broadcasting station. If a transmitting licence is issued to the holder of a receiving licence an additional fee at the rate of 2s. 6d. a quarter will be charged. A licensee of a broadcasting station shall within one month after the issue of the licence give an undertaking, supported by a guarantee of £1,000, to commence the broadcasting service within six months. Broadcast receiving licences will be issued for one year.

Radio-Broadcasting.—First English Relay Station.—The first of a series of relay stations to be set up by the British Broadcasting Co. is now operating at Sheffield with excellent results. The method is to connect the microphone at the Manchester broadcasting station with a telephone line direct to the Sheffield relay station, thus eliminating the receiving station which had been set up on the outskirts of the city. The Postmaster-General has set aside a line for this purpose between 6 and 10.30 each evening. The Manchester programme is relayed on a 350-metre wave length, and once per week the programme broadcast is to be wholly "made in Sheffield." It is, of course, the users of the chéaper outfits who specially benefit by this scheme of re-laying, users of valve sets being able to secure the messages from the various broadcasting stations satisfactorily.

Jugo-Slavia.—Belgrade Radio Station.—Work has been started on a new 100-kW raido station at Rakovica, about 4 kilometres from Belgrade, and on a receiving station at Laudon Trench, a suburb of that city. The station is being built by the French Wireless Telegraph Co., and the total cost is estimated at 38,000,000 dinars. On its completion the entire installation will be taken over by the State. The operating *personnel* will become employés of the Department of Posts and Telegraphs, the company maintaining one engineer as a technical adviser. The agreement covering the construction of the station provides for its operation on the basis that 12 per cent. of the gross receipts go to the Treasury and the remainder towards the payment of operating expenses. If there should be a net profit from the operation of the station, however, the State is to receive 20 per cent. of the amount. After a period of 30 years the station becomes the property of the Government without any further payment; beginning with the eleventh year, the State has the option of purchase at any time it desires. Should the station fail to function as provided in the contract, the State has the right to purchase it at any time. This particular station will be the first high power radio installation in the Balkans.—*Commerce Reports.*

Sweden.—Radio-Telephony.—The British Legation at Stockholm informs the Department of Overseas Trade that a radio broadcasting company has been established in Sweden under the name "Svenska Rundradioaktiebolaget." The published prospectus of the company is signed by the following important firms: Allgemeine Elektricitats Gesellschaft, A/B Nordiska Kompaniet, Allm. Svenska Elektriska A/B, Allm. Telefonaktiebolaget L. M. Ericsson, A/B Radiokompaniet Svenska Radioaktiebolaget, and Ahlen & Holm A/B. The capital will be at least 100,000 kr., not exceeding 500,000 kr. in shares of 100 kr. each; the dividend is limited to 7½ per cent. cumulative. It is understood that the company will have exclusive rights for broadcasting in Sweden from 1924 to 1934 with a preferential claim to renewal on the expiry of these rights. Further, licences for the use of receiving apparatus are to be granted freely to the public, *i.e.*, with as few formalties as possible. No restrictions are to be made with respect to the construction of receiving apparatus, except that licences are not to be granted for the use of apparatus likely to cause disturbance to other receivers. Military and commercial secrets are to be protected by other means, such as ciphers. It was originally proposed that Swedish manufacturers should be protected by Customs duties and against home competition by State control, but it is understood that these proposals have been rejected.

Lithuania. — Kovno Radio Station. — The Lithuanian Cabinet has decided to approve the order given to a French firm of contractors for the erection of a large radio station near Kovno, the cost of which is estimated at 61,000 dollars. —*Reuter's Trade Service* (Kovno).

Wireless Trade.—At an emergency meeting of the Wireless Committee of the Electrical Importers' and Traders' Association, held on Wednesday, the following resolution was passed in reference to the Broadcasting Committee's report:—"That this meeting warmly welcomes the comprehensive and able report of the Broadcasting Committee, which so amply justifies the trade criticisms which gave rise to the controversy last spring, and maintains so vigorously the principles for which this Association and the trade at large has contended; but notes with surprise that the Postmaster-General has failed to give effect to the essential recommendations of the committee and has elected instead to perpetuate in the main a system which stands condemned in the committee's report and tends to support monopoly.

"This meeting strongly protests against the use of the powers of a single Government department to override the fiscal policy of the country by placing a veto on imports without the consent of Parliament, and thus, without statutory inquiry, debarring the public from the benefits that should be derived from the research and efficiency of our Dominions and other countries overseas."—*Evening Standard.*

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the* Electrical Review *in which the "Official Notice" appeared in our advertisement pages.)

OPEN.

Argentina.—Buenos Aires.—November 2nd. State Railways. Electrical material (specification 15,00 pesos, paper). The Department of Overseas Trade states that it has not received any further particulars.

Australia. — Melbourne (Victoria).—October 24th. Victorian Government Railways. Electric hoists.*

Sydney.—December 3rd. City Council. H.p. feeder and pilot cables.*

December 12th. New South Wales Government Railways and Tramways. Rotary converter units.*

January 21st. H.p. split conductor feeder panels.*

Barking.—October 9th. Electricity and Tramways Committee. Reconstruction of the Barking and Becton Light Railways. Rails, fishplates and bolts, permanent-way construction. (September 21st.)

October 22nd. County of London Electric Supply Co., Ltd. Construction of a tunnel under the River Thames at Barking in connection with the new power station scheme. Specification from Sir Alexr. Gibb & Partners, Queen Anne's Lodge, S.W.1.

Belgium.—Antwerp.—October 16th. Fifteen 3-ton electric cranes. Hôtel de Ville, Anvers.

Ghent.—October 29th. Eight electric cranes and 560 metres of track. Hôtel de Ville, Gand.

Brussels.—October 31st. Telephone switchboards, with lamps and other accessories; also telephone posts and accessories, for the Mons telephone exchange. Particulars, Salle de la Madeleine, Galerie Boitier, Brussels.

November 14th. Belgian Post and Telegraph authorities at La Salle Madeleine, Brussels. Installation of telephone switchboards and other accessories required in connection with an inter-urban telephone system which is to be installed at the Liége telephone exchange. Particulars for 5 fr. (Cahier des Charges Special, No. 739).

October 17th. Belgian State Railway authorities (Office de l'Electricité), 25, Rue de la Charité, Brussels. Supply of electric cables. Particulars on application, Cahier des Charges Special, No. 1,381.

October 24th. Municipal authorities of Dison (Province of Liége). Concession for the supply of electricity for lighting and power purposes in the town. Particulars for 25 fr.

The municipal authorities of Villers-Saint Simeon (Province of Liége) have this week invited tenders for the concession for the supply of electricity for lighting and power purposes in the town.

Blackpool.—Electricity Department. H.p. and l.p. paper-insulated lead-covered armoured cables. (See this issue.)

Chartham, near Canterbury. — October 12th. Kent County Mental Hospital Committee. Telephone installation. (September 28th.)

Cheadle and Gatley. — October 8th. Urban District Council. Sub-station switchgear. (September 21st.)

Denmark.—Copenhagen.—October 11th. Municipal Council. One electric crane for unloading coal.*

Egypt.—Cairo.—October 27th. Education Department. One generator, two electric motors (12 h.p.), two ditto (6 h.p.), with switchboards, &c., required for Cairo model workshops. Specification from the Stores Department of the Ministry of Education.

Falmouth.—October 15th. Board of Guardians. Installation of electric lighting at the Poor Law Institution. (September 21st.)

Haddington.—Co-operative Society. Work (including electric lighting and power) in connection with the alterations at Market Place, North Berwick. Mr. Thos. Deans, general manager, Lodge Street, Haddington.

Ilford.—The Urban Council has decided to obtain quotations from British firms only for the supply of 50 tons of tram rails.

Ilkley.—October 10th. Electricity Department. Three 250-kW rotary-converters, transformers, and switchgear. (See this issue.)

Leek.—October 17th. Electricity Department. One 400-kW, d.c. generator and one open-type cooling tower. (See this issue.)

London.—London County Council.—October 15th. Single and double pole track and test panels. (September 21st.)
October 8th. Withdrawing, repairing, relaying, and jointing existing l.p. cables. (September 21st.)
Islington.—October 8th. Cleansing Department. Two new lead batteries for 3½-ton Orwell & Edison dust-collecting vehicles. (September 21st.)
H.M. Office of Works.—October 19th. One 3,000-V, 3-ph. motor and compressor, &c. (See this issue.)

New Zealand.—Wellington.—Public Works Department. November 27th. Two recording instrument panels.*
November 20th. Portable testing instruments for Mangahao power plant.*

Nottingham.—October 19th. Electricity Department. One 25-ton overheading travelling electric crane. Specifications from Messrs. Preece, Cardew & Rider, 8, Queen Anne's Gate, S.W.1.

Pontypridd.—October 8th. Electricity Department. One 500-kW rotary-converter and transformer, and e.h.p. and l.p. switch cubicles. (September 28th.)

Reading. — November 3rd. Corporation. Complete equipment of an air-compressing station at Manor Farm, Reading, consisting of e.h. and l.p. switchboards and motors, transformers, air compressors, piping, valves, cables, measuring apparatus, cooling tank, &c. (See this issue.)

Salford.—October 16th. Board of Guardians. Distributing boards and electric cables for 10 motors and 4 ventilating fans; fuses, switches, and fittings, including enamelled shades for 56 lights, in addition to 8 plugs for hand lamps, for new laundry at Hope, Pendleton. Mr. E. H. Inchley, Clerk to Guardians, Poor Law Offices, Eccles New Road, Salford.

South Africa.—Johannesburg.—November 1st. Municipal Council. Joint box compound, cut-outs, and insulating tape.*

Sunderland.—October 15th. Board of Guardians. Static transformer, main switchboard and distribution mains, well motor drive, wiring central area, certain specified blocks and East Block, motors, &c. (September 21st.)

Stoke-on-Trent.—November 14th. Electricity Department. E.h.p. and l.p. switchgear for transforming sub-station, Marsh Street. (See this issue.)

Uruguay.—Montevideo.—November 1st. State Electricity works. 24,750 fuse fittings, including 3,000 distributing fuses with bipolar or tripolar fuses, for Edison screw plugs.*

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

CLOSED.

Aberdeen.—Electricity Committee. Accepted:—
Coal-handling plant.—New Conveyor Co., Ltd.

Barking.—County of London Electric Supply Co., Ltd.—The building contract for the erection of the power station at Barking has been awarded to the Consolidated Construction Co., of Cloak Lane, E.C.

Belgium.—The Société de l'Electricité de Seraing et Extensions, of Brussels, has secured the concession for the supply of electricity for lighting and power purposes in the little towns of Wihogne, Juprelle, and Paifve.
Seven concerns—five Belgian and two French—submitted tenders last week to the Belgian Post and Telegraph authorities in Brussels for the supply of 300 tons of bronze wire, in five lots, the lowest offer being that of E. Geisler-Lignian, of Brussels.

Chesterfield.—Electricity Committee. Accepted:—
Induced-draught plant (£834).—Musgrave & Co., Ltd.

Dundee.—Although Belgian offers were lower, the Corporation Electricity Committee accepted British offers to supply cable. Respective prices for three lots were:—Belgian, £100; British £101 10s.; Belgian, £242; British, £255 4s.; Belgian, £171 10s.; British, £188 10s.

Erith.—Urban Council. Accepted:—
Additional tramway loop (£144).—Hadfields, Ltd.

France. — Paris. — Gennevilliers power station.—Messrs. Aiton & Co., Ltd., have secured the contract for the supply of pipes required for the extension at the power station, and also for a new plant which is to be laid down by the same syndicate.

Glasgow.—Electricity Department. Recommended:—
Additional plant for Dalmarnock power station.
Two turbo-alternator sets (£180,000).—C. A. Parsons & Co., Ltd.
Condensing plant.—C. A. Parsons & Co., Ltd. Sub-contractors: Mirrlees, Watson & Co., Ltd.
Enclosed-type h.p. switchgear (£34,000).—Reyrolle & Co., Ltd.
Eight boilers.—Babcock & Wilcox, Ltd.
Six chain-grate stokers.—Babcock & Wilcox, Ltd.
Six ditto.—Underfeed Stoker Co., Ltd.
Economisers.—Green's Economiser Co., Ltd.

Halifax.—Electricity and Tramways Committee.
One 10,000-kW steam turbine, alternator, and exciter (£28,502).—British Thomson-Houston Co., Ltd.
Condenser (£13,685).—Worthington-Simpson, Ltd.
Housing Committee. Accepted:—
Electrician's work in connection with housing scheme at Beechwood Road (£536).—F. S. Jackson.

Hazel Grove and Bramhall.—Urban District Council. Accepted:—
Cables.—W. T. Glover & Co., Ltd.
Sub-station switchgear.—Ferguson, Pailin, Ltd.
Meters.—Ferranti, Ltd.

Ilford.—Urban Council. Accepted:—
L.p. cables (£579).—Union Cable Co., Ltd.

Leven (Fife).—Town Council. Accepted:—
Electrical work in connection with two housing schemes (£184).—Morriell Bros.

London.—Government Contracts.—General Post Office.
Vacuum and gasfilled-type lamps for the 12 months ending August 31st, 1924.—Siemens & English Electric Lamp Co., Ltd.
St. Marylebone.—Electric Supply Committee. Recommended:—
House-service meters for 12 months.—Chamberlain & Hookham, Ltd., and Ferranti, Ltd.

Manchester.—Education Committee. Accepted:—
Electric lighting installations at the following schools:—
Orford Street and Manley Park.—R. S. Miller.
Clarendon Road.—Power & Lighting Supplies, Ltd.
Beaver Road.—Clampett & Co.
Cromsworth.—Ward & Booth.
Whalley Range High.—Seddon & Sons.
Swinton House Special.—Manchester.
Electricity Committee.
Steelwork with gallery and staircase for the new sub-station in Chapman Street, Gorton.—Robinson & Kershaw.
Cables.—British Insulated & Helsby Cables, Ltd., and Pirelli-General Cable Works, Ltd.
Tramways Committee.
Simplex jacks.—Equipment & Engineering Co.
Tramway bonds.—A. & J. M. Anderson Manufacturing Co.
Tramway rail bonds.—British Insulated & Helsby Cables, Ltd.
Steel girder tramway rails.—Cargo Fleet Iron Co., Ltd.
Steel tramway poles.—British Mannesmann Tube Co., Ltd.
Span wire brackets.—Naylor Bros., Ltd.

Seahouses.—Messrs. F. Reid, Ferens & Co., of Newcastle-upon-Tyne, have received the order to supply the necessary machinery, transmission lines, and complete equipment for the electrical installation at Seahouses, North Sunderland, and St. Aidans. They have received orders from practically the whole of the inhabitants for the installation of electricity in the various houses and fish-curing premises.

Wrexham.—Town Council. Accepted:—
H.p. switchgear for the Acton Park sub-station (£120).—British Thomson-Houston Co., Ltd.
Transformer (£99).—Ferranti, Ltd.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

Requests for information must be accompanied by a stamped addressed envelope.

We should be glad if any reader could advise us of the names and addresses of the makers of:—

Metaphone telephones.
New Eba blocks.
Bergmann insulated tubes with metallic casing.

FORTHCOMING EVENTS.

National Association of Supervising Electricians.—Tuesday, October 9th. At St. Bride's Institute, E.C. At 6.45 p.m. Lecture on "Present-day Heavy Oil Engines," by Mr. J. L. Chaloner.

Societe des Ingenieurs Civils de France (British Section).—Wednesday, October 10th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 6 p.m. Presidential address by Mr. R. T. Smith.

Institution of Engineers-in-Charge.—Wednesday, October 10th. At St. Bride's Institute, E.C. At 7.30 p.m. Presidential address on "Engineering Records and Their Value to the Engineer-in-Charge," by Mr. T. Cooper.

Institution of Welding Engineers.—Wednesday, October 10th. At Holborn Restaurant. At 8 p.m. Papers on "Electric and Gas Welding."

Electrical Power Engineers' Association (Manchester Section).—Thursday, October 11th. At the Geographical Chambers, Manchester. At 7.15 p.m. Paper on "The Parallel Running of Steam Power Stations," by Mr. O. Howarth.

Northampton Engineering College Engineering Society.—Thursday, October 11th. At the College, St. John Street, E.C. At 5.30 p.m. Presidential address by Dr. R. M. Walmsley, and a paper on "Fatigue," by Mr. C. E. Larard.

Electro-Harmonic Society.—Friday, October 12th. At Caxton Hall, Westminster, S.W. At 8 p.m. Smoking concert.

Junior Institution of Engineers.—Friday, October 12th. At 39, Victoria Street, S.W. At 7.30 p.m. Paper on "The Non-Stop Railway," by Mr. W. Yorath Lewis.

NOTES.

Electrically-propelled Barges.—With reference to the article in our issue of September 7th on the subject of the electrically-driven barge at Kidderminster, we are informed that the Executive Committee of the National Council for Inland Waterways inspected this installation on September 28th. The party, which included Mr. P. J. Hannon, M.P. (chairman), Mr. A. J. Butler (Staffs. and Worcs. Canal and Severn Commission), Mr. Cyril Lloyd, M.P., Col. Saner (Weaver Navigation), Sir S. Humphries (Port of Bristol), Col. Kayner (Trent Navigation), General Long (Lever Bros.), Mr. E. Manning Lewis (Sharpness New Docks and Birmingham-Worcester Canal), Mr. C. F. Jones (Fellows, Morton & Clayton), Messrs. W. H. Bowater, G. Fisher and others, was taken for a trip over the length electrified, and expressed approval of the system, particularly of the flexibility (the reversal test from full speed ahead to full speed astern occupying 18 seconds). Demonstrations of the ease with which the barge releases itself from a mud bank after being driven on at full power were witnessed. On the return journey the departure was delayed for a few minutes to allow a heavily laden barge with a tin plate cargo to pass through the lock and accept a friendly tow over the whole length of the electrified portion, this procedure being heartily approved by the horse. The Committee later held a meeting in the Kidderminster Town Hall.

French Electric Vehicle Trials.—Eighteen vehicles are taking part in the reliability trial of electric vehicles which commenced at Belleville, near Paris, on Friday last week. The competing machines comprise three Kriegers, two by the Société d'Applications Electro-mecaniques, three by the Société d'Appareils de Transport et de Manutention Electriques, two by the Société Cuvile d'Etudes de Materiel de Traction, two by Laporte & Fils, two by Messrs. Crochat, three by the Société Berliet, of Lyons, and two by the Société des Vehicules Electriques, of Paris.

According to *Reuter* the National Office of Inventions and Industrial and Scientific Research, the Union of Electrical Syndicates, and the French Automobile Club are conducting the experiments in order to determine the practicability of the wider use of electrically-driven vehicles. After having charged their accumulators, eighteen lorries and cars left Bellvue, just outside Paris, and drove round the suburbs. The trials will be continued for ten days. It is pointed out that there are now 180,000 electrically-driven vehicles in the United States, 30,000 in Great Britain, and 3,000 in Italy. Since in France petrol is expensive and water-power abundant, it is urged that the perfection of electrically-driven cars would result in effecting a national economy.

Faraday House Old Students' Association.—We understand that the fifteenth annual dinner of the Faraday House Old Students' Association will be held at the Hotel Cecil on October 19th. Mr. H. W. Miller, M.I.E.E., will be in the chair, and members may introduce guests, who need not necessarily be Faradians. A musical entertainment will, as usual, follow the dinner, and old students who are desirous of attending should make early application for tickets to the Secretary, Faraday House, Southampton Row, London, W.C.1.

The Proposed Calcutta "Tube."—Dealing with the traffic problem of Calcutta recently, a writer in *Indian Engineering* comments adversely upon the proposals to construct an underground railway for the city.

His criticism falls under three heads. In the first place, he says that the Oriental mind could not adapt itself to the conditions which make a "tube" service a success; trains could not be emptied and filled fast enough. Secondly, he considers that a low-level tube in the soft alluvium of Calcutta would not be safe. It would be necessary to go deeper down, and this would make the cost prohibitive, somewhere in the neighbourhood of a million pounds a mile. The third objection is the difficulty of ventilation, which, the writer points out, is sufficiently difficult in European underground railways; the temperature would approach the intolerable in a Calcutta "tube."

The writer's remedies for the existing traffic congestion are the banning of bullock carts from the main thoroughfares, and increased tramway and omnibus facilities.

Fatality.—An inquest into the death of Mr. Ernest Wildash was held at Marylebone on September 28th. Mr. G. M. Williams, managing director of Neon Lights, Ltd., said that deceased was engaged in testing a neon tube lighting system at the Palladium in which a pressure of 4,900 volts was employed. Deceased was an expert in high-pressure electrical work and possessed considerable experience of the neon-tube system.

An L.C.C. electrical inspector said that there could be no doubt that deceased, in testing the installation, used a dangerous but quick method in preference to a slower but safer arrangement. In such cases experts almost always "took the risk."

A verdict of "Death by misadventure" was returned.

Electricity and the Preservation of Food.—Public interest has been aroused by articles in the Press on the use of food preservatives. A recent writer pointed out that much of the food preservation work carried out now with chemicals could perhaps be effected with "Cold." He suggested that "Cold" might be laid on like water, gas and electricity. In this connection Mr. J .W. Beauchamp, of the E.D.A., points out that it would be a convenience to lay on "cold" and "vacuum" as we do electricity and water; the time for it is perhaps not yet, but there is a problem for the inventor which has never been solved, even if it is capable of solution—that is, the easy abstraction of heat from bodies but little hotter than the surrounding air. It is so simple with electricity to deliver heat or raise the temperature of a body and so much more complicated to deliver "cold" or extract heat from a body. There are refrigerating appliances, but they mostly contain reciprocating machinery, and the smallest are apt to represent considerable expenditure. The inventor who can give us the inverse of the electric fire and, for a few pounds, provide a cupboard or receptacle in which a body can be chilled or kept cold by a small expenditure of electrical energy should secure a big reward.

Electrical Legislation in the Irish Free State.—In the Irish Free State Dail Mr. McGrath, Minister of Industry and Commerce, recently stated that Electricity Commissioners under the Electricity (Supply) Act, 1919, had not yet been appointed in the Free State, the amount of work under the Act not justifying the expense. The Ministry's Bill, to be introduced shortly, would provide that the functions of the Electricity Commissioners should be exercised by the Ministry of Industry and Commerce pending the introduction of a Bill, already in draft, to codify and amend the law relating to electric supply.

The Dark Ages.—In his "Reminiscences of a Pioneer," which he is contributing to the *M. & C. Apprentices' Magazine* (Messrs. Mavor & Coulson), Mr. Henry Edmunds, M.Inst.C.E., says: "When I was looking for a house in the Herne Hill district (in 1890), an agent having given me several introductions, I presented the card to the maid who opened the door, and she asked me to wait, ushering me into a very comfortably furnished sitting-room, where I noticed several pictures on the wall. I was more particularly drawn to an illuminated address, in which there appeared to be some reference to electric lighting; and I was much startled to read that the gentleman who had received this address was thanked on behalf of the district (not very far away from the Crystal Palace) for his successful efforts in preventing the introduction of electric lighting into that locality."

V.D.E. Meeting Abandoned.—Owing to the abnormality of the present time in Germany it has been decided not to hold the usual yearly meeting of the Verband Deutscher Electrotechniker this year. The next meeting will be held in Dresden in 1924.

Compensation for Hampstead Engineers.—By an agreement made in September, 1922, the Marylebone Borough Council undertook to supply in bulk the whole of the electricity required by the Hampstead Borough Council. This involved the cessation of generation at the Hampstead station, with a consequent reorganisation of the staff, and four engineers employed by the Council were prejudicially affected thereby. They accordingly took advantage of Section 16 of the Electricity (Supply) Act, 1919, and claimed compensation. Sir William Mackenzie, K.C., was appointed arbitrator in the matter and the terms of his award, issued at the end of August, are reproduced in the September *Electrical Power Engineer*. The arbitrator finds that the principal claimant, Mr. F. B. O'Hanlon, has suffered loss of employment; he is therefore awarded a sum of £2,100. Messrs. A. B. Geddie, W. E. Walker, and C. S. Anscomb have suffered diminution of salary, and have been placed in a worse position with regard to conditions of service; they are accordingly awarded as compensation sums of £140, £280, and £100 respectively.

The costs of the arbitration and those incurred by the claimants are to be paid by the Hampstead Council; the Council will also bear its own costs.

Electricity at Wembley.—We are informed that work has now been started on the electric power station at the British Empire Exhibition. As our readers already know, the power station is itself to form one of the exhibits in the Electrical and Allied Industries Section of the Palace of Engineering. Visitors will be invited to inspect the station, and see for themselves what British firms have to offer in the way of plant. A special gallery is being built from which visitors will be able to view the machinery at work. The British Electrical and Allied Manufacturers' Association has assisted the consulting engineers in planning the power station on lines that will make it representative of some forty electrical manufacturing firms. The station will be situated on the northern side of the Palace of Engineering. The main features will be three 1,500-kW turbo-generators of the most recent type, supplied with steam from two different types of water-tube boilers. Each of these generators will be the work of a different firm, and in the same way the condensing plants, air filters, rotary converters, transformers, cooling towers, switchgear, batteries, and so on will be of different makes. For purposes of demonstration a section of the industry is showing other forms of power producers. In the main hall there will be exhibited a low-speed steam set and a horizontal internal-combustion set, each generating 300 kW. These will be run under load on stands, and will be coupled up to the body of the plant through panels on the main switchboard.

Thousands of tons of copper, in the form of hundreds of miles of electric cable, are being buried in the grounds, and a new scheme of artificial lighting has been devised. The whole of the lighting will be under the control of one man, who will have at his disposal electricity representing 5,000 h.p. The general aim of the lighting section is to produce a broad luminous effect, which will show up the buildings, emphasise the beauty of their structure and outlines, and harmonise with the changes of temperature. This will be achieved by an elaborate scheme of colour lighting. The ornamental lake, which stretches from east to west across the centre of the main Exhibition grounds, will be lighted from four boats, which will direct powerful beams of coloured light below and along the surface of the water. The beams of light below the surface will be caught by mirrors on the bed of the lake and reflected upwards at various angles. The sky will also be used to show lighting effects; a perpendicular beam will be sent upwards from the electrical section of the Palace of Engineering.

A New Selenium Cell.—The promise of our being able to see "over the telephone line" has often been made, but the electrical properties of selenium, the "eye" which has been used to transmit the light picture, have not always come up to the mark. Mr. William Prior, an English electrical engineer, claims to have invented a new selenium cell which is so rapid in its response to light changes and of such great sensitiveness that we are brought a step nearer to the solution of this fascinating problem.

Mr. Prior's cell may prove of great value in solving the popular problem of reproducing sounds with the kinematograph.—*Daily Mail.*

Gas and Electricity.—Mr. W. Bryant, presiding on September 24th at the annual meeting of the Truro Gas Co., referred to the possibility of electric light being introduced into the town. What effect that would have on their undertaking, he said, it was difficult to prophesy, but elsewhere in the county where electricity had been adopted it had resulted in an increased consumption of gas, and he saw no reason why they should not have the same experience in Truro. Mr. S. J. Ingram, the managing director and engineer of the Gas Co., gave it as his opinion that it was impossible for the Corporation to secure an electricity supply on an economic basis.

E.D.A. Slogan Competition.—The special committee appointed by the E.D.A. to adjudicate in the recent slogan competition has completed its work. Nearly 2,000 slogans were submitted by 194 competitors and the following phrases have been selected as most closely meeting the requirements. Prizes have been awarded as follows:—

(1) "Just Touch that Switch."
Prize of £10 awarded to Mr. E. A. Joyce, London, S.W.

(2) "Electrify and Troubles Fly."
Prize of £5 awarded to Miss M. I. Dewdney, London, N.

(3) "The Right Way—The Electric Way."
Prize of £3 awarded to Mr. A. C. Bastel, Electricity Showrooms, Croydon.

The task of arriving at these decisions was not an easy one and the Committee states that on the whole the standard of literary ability, ingenuity, and imagination displayed was very disappointing, and that a phrase containing all the essential elements of a good slogan has yet to be produced. It is not an easy subject, by any means, and it may be consoling to competitors to know that this lack of ability to produce a really good slogan is felt as much by our contemporaries on the other side of the Atlantic as in this country.

A slogan is neither the most nor the least important feature of advertising. Many thousands have been created for various commodities, but rarely one which can be regarded as a total eclipse. The electrical slogan which will most nearly approach the standard will contain a general reference to the industry and not to any particular application of it; it will contain a word such as "Electricity," "Electrify," "Switch," or something similar in order to make its meaning quite clear; it will not suggest the curtailment of anybody else's business, such as "Gas," "Coal," or even the "Doctor," it will be brief, human, and definite. We wait for the *immortal* who can produce it.

Appointments Vacant.—Teacher (evening) in electrical engineering, for the Goldsmiths' College, New Cross, S.E.; plumber-jointer, for the Nelson Corporation electricity department; shift engineer-in-charge, for the Oldham Corporation Electricity Committee; assistant distribution engineer, for the Chester Corporation electricity department. (See our advertisement pages to-day.)

New G.W.R. Jetty.—On September 27th, Lord Mildmay of Flete, one of the directors of the Great Western Railway Co., formally inaugurated an electrically-equipped jetty, which the company has constructed at Fowey, Cornwall, which is the exporting centre of the china clay industry. Special cranes and a comprehensive system of conveyors have been installed, speeding up the handling capacity of the port from 300 to 1,000 tons per hour. The jetty and machinery, which have been constructed and erected under the supervision of Mr. R. T. Smith, represent an expenditure of nearly £300,000.

"As She is Spoke."—The following is a copy of a letter received by Mr. D. McLeod when he was assistant electrical engineer to the Gold Coast Government Railways, from a native wireman employed under him:—

Secrondee.

Dear Sir,

I beg most respectfully to induce before you this my humby Pettition, And I hope you will not fail to show your mercy to me, Please Sir one of my friend owes me Six Pounds fifth Shilling and four Pence been the money land from me but I got a letter at Presteah that the man is ready to franch land. Again the man who have stoled my money is the same place he too five Pounds ten shilling and two penneys I therefore beging your Pardon to try your best land one Pound five shilling £1 5s. 0d. that I may pay my Passage to go there this Saturday and I shall return back on Monday morning Please I don't know that the matter will come like that I send all my money at home nothing with me here naw. Sir I beg you to try your utmost best and do the same for me for God's sake but not for my own experience Sir hope this my humbly Pettion will convienced you to have mercy on me and fillfuled my desires. Ending with my best love. Thanks in anticipation

Yours obediently J. A. Acquah.

The Situation in Japan.—His Majesty's Chargé d'Affaires at Tokio reports by cable under date September 25th, that, according to a statement of the Japanese Minister of Foreign Affairs, it has definitely been decided to reconstruct Yokohama as a port, the damage to the harbour works having proved less extensive than was originally estimated. It is understood that Yokohama will remain the port of export of silk from Japan. The Commercial Attaché to the Japanese Embassy in London has informed the Department that telegraphic information received from the Foreign Office at Tokio is to the effect that repairing work is already in progress at Yokohama, and it is hoped that by the end of October, ordinary port facilities will be re-established. At Kobé, special arrangements have been made to deal with the congestion created by the diversion of vessels to this port, and the situation is improving.

The Federation of British Industries has invited Sir E. T. F. Crowe, C.M.G., British Commercial Counsellor for Japan, who is at present in this country, to address a meeting of members interested in Japan at the offices of the Federation on Tuesday next, October 9th, at 3 o'clock. Sir Edward will deal, in particular, with the opportunities afforded for British goods in Japan in connection with the reconstruction work. The Federation has received communications from several members interested in the proposal to form a group of non-competing manufacturers of constructional, building and other materials likely to be used in connection with the reconstruction work in Japan, for the purpose of sending out a joint technical representative to take charge of their interests on the spot. Concrete suggestions will probably be laid before members at the meeting above referred to.

Ash-handling Plant at Cardiff.—A very compact ash plant of the mechanical conveyor type has recently been installed at the Roath power station of the Cardiff Corporation. Messrs. Ed. Bennis & Co., Ltd., have installed a number of sets of ash-handling plant on the pneumatic or steam jet principles, but never one in which a modification of the well-known U-link conveyor is used for the same purpose. Conveyors of similar construction have been used for the removal of furnace ashes, but while with these the ashes are quenched and conveyed in a trough containing water, the installation under review receives the ashes in the red-hot state and conveys and delivers them *via* a bucket elevator of appropriate construction, in a continuous stream, into waiting road vehicles. Since the movement of the ashes during the hand-

ling process is slow, they are cooled sufficiently on arrival at the delivery terminal to be loaded and carried away.

The plant has a capacity of 5 tons per hour. The tray conveyor, which has a total length from centre to centre of 70 ft., is provided with a standard U-link chain, to which is attached a series of cast-steel trays to form an articulated endless moving cast-steel trough. The pins which join the links together are extended at each side to form trunnions on which cast-iron rollers revolve, two to each tray. The rollers travel on a stationary channel-steel track, extending the whole length of the conveyor. The driving terminal wheel is at the delivery end and the tension gear is of the screw take-up type. The width of the trays is 14 in. and the conveyor runs at 27 ft. per minute. The ashes do not come into contact with the chain or rollers and no spilling of the ashes can take place between or on to the links or rollers. An 8-b.h.p. motor is employed for driving the elevator and conveyor.

The bucket elevator is of the fully-enclosed type; the buckets are 10 in. long, 7 in. wide, and 6 in. deep. The elevator runs at a speed of 80 ft. per minute.

The driving motor is located on the basement floor and drives through countershafting and chains.

B.E.S.A. Specifications.—The British Engineering Standards Association has recently issued the following specifications: No. 116, 1923, for oil-immersed switches and circuit breakers for alternating-current circuits. No. 157, 1923, for moulded flat-top insulating bushes. No. 160, 1923, for slate slabs for electrical purposes. Specification No. 116 completes the series of switchgear specifications, of which there are now seven published. The ratings standardised range from 600 to 15,000 volts and 30 to 6,000 amperes.

Much consideration has been given to the breaking capacity and the Committee responsible for the preparation of the specifications arranged for extensive experimental work to be undertaken as there was no information available to enable it to lay down definite specifications for breaking capacity for large sizes. As soon as the British Electrical and Allied Industries Research Association was properly organised this work was referred to it, and research on a large scale has been put in hand. This should prove of the greatest value to the industry and it is hoped that results will be available in time for the next revision of the specification.

Specifications No. 157 and 160 are principally dimensional and have been prepared by a committee which is engaged on the standardisation of assembled switchgear as a whole and switchboard equipment. It is hoped that the whole industry will adopt these sizes as soon as possible in order that the full benefits of standardisation work of this nature may be felt quickly.

Specifications for switchboard busbars and connections and the arrangement and marking of busbars will shortly be issued.

Ferro-Silicon in Norway.—The experimental production of ferro-silicon has been begun in the Saude Fjord, about 55 miles from Stavanger, on the west coast of Norway, and that of ferro-manganese is also shortly to be started for the American market. The Electric Furnace Products Co., which is a branch of the big works at Niagara Falls, began the erection of the works in Norway in 1915 and a sum of 28,000,000 kr. of American money has been invested in the works and the erection of a quay and equipment to deal with larger ships. At present there is one furnace of 9,000 h.p. at work and power is obtained from the A. S. Saudefoldene, whose hydro-electric works will ultimately have a capacity of 130,000 turbine horse-power.

Electricity Supply in the United States.—Reports received by the *Electrical World* show that United States supply companies sold 32,480,000,000 kWh during the first six months of this year, an increase of 25.4 per cent. over the corresponding period of 1922. The output has practically doubled in four years. The revenue for the six months was $649,300,000, as compared with $542,900,000, a gain of 19.5 per cent.

The Electro-Harmonic Society.—The first smoking concert of the season will be held in the Caxton Hall, Westminster, on Friday, October 12th, commencing at 8 o'clock. Chairman: Major-Gen. Sir Philip Nash, K.C.M.G., chairman, Metropolitan-Vickers Electrical Co., Ltd. The following artistes have been engaged:—Miss Marion Browne, soprano; Miss Marjorie Booth, contralto; Mr. Ivor Walters, tenor; Mr. Edern Jones, baritone; Miss Josephine La Barte, songs and impressions; Mr. William Primrose, violinist; Mr. Rex Harold, entertainer; Mr. Bernard Flanders, A.R.A.M., solo pianoforte and accompanist.

United States Electric Vehicle Market.—The United States electric vehicle market was quieter during the month ended September 22nd. Although fewer sales were made, the largest truck works continued operating at capacity, and manufacturers expect that when the old contracts on which they are now working have been filled, there will be plenty of new orders on their books. The American Express Co. recently placed an order for 40 3½-ton trucks, each to be equipped with spare batteries, for service in New York. The same company also purchased eight trucks of the same type for use in Cleveland, Ohio. The National Biscuit Co. has cut down the number of horses in its service from 145 to 65, and horse trucks have been replaced by ten electric trucks. The change in equipment has enabled the company to effect a saving of 1½ per cent. on each dollar's worth of merchandise delivered. The Corby Baking Co., of Washington, D.C., has just put 60 more electric trucks into service in that city. A New York firm recently bought seven electric trucks, which have replaced 20 horses and equipment. Another concern is now purchasing second-hand electric trucks, which will replace 52 horses.

A coal company which bought a 6-ton electric truck as an experiment is so pleased with the new vehicle that it has ordered another of the same kind and will shortly place an additional contract for four more.

An Electric Vehicle School for Salesmen—the third of its kind in the United States—is to be opened in San Francisco on October 8th, under the auspices of the Electric Transportation Bureau of the National Electric Light Association.

Electric trucks, parts, and accessories will be prominently featured in the annual Electrical and Industrial Exposition which will be held in New York from October 27th to 29th.

Thirty-five electric trucks and passenger cars, valued at 45,831 dollars, were exported from the United States during July, 1923, against 29, valued at 35,954 dollars, during July, 1922.—*Reuter's Trade Service.*

South African Trade.—A *Reuter Trade Service* report from Johannesburg, dated September 10th, stated that buying on behalf of the Witwatersrand mines was still restricted, though September opened briskly. Inquiries were, however, being received from Rhodesia, where some very promising propositions were being exploited. Some considerable developments in electrical power supply schemes were also likely to be heard of in the near future, but financial considerations were at present hindering progress. The building trade was still steady. Engineering shops were only moderately busy, and tenders were being invited on a scale that should hold out prospects of more activity in the near future. The second-hand market for mining and engineering supplies of all kinds was still suffering from short supplies. The opportunity of picking up bargains on mines in process of dismantling seemed to be a thing of the past, consequent on the keenness of the demand shown by dealers.

INSTITUTION NOTES.

Institution of Public Lighting Engineers.—Dissatisfaction with the indifferent conditions prevailing in public street lighting in this country has been manifested for some time past, and it has been alleged that the conditions can only be remedied by the formation of a separate organisation for the advancement of the study of the practice and science of street lighting. A meeting was therefore convened on September 21st at the National Gas Exhibition at Birmingham to discuss the formation of such an association, and it was unanimously resolved that an association or organisation for officers concerned with public lighting be formed forthwith. Resolutions were also carried that Mr. S. B. Langlands (Inspector of Lighting to the City of Glasgow) be appointed president; Mr. W. J. Liberty (Inspector of Lighting to the City Corporation of London) vice-president; with Mr. Crane Cooper (Inspector of Lighting, Wakefield) as hon. secretary. The following gentlemen, in addition, were appointed members of the Executive Committee, *viz.*:—Messrs. Langlands, Liberty, Cooper, R. Mason (Superintendent of Lighting, Birmingham), E. F. Spurrell (Borough Surveyor, Holborn), C. Chambers-Smith (London), and T. Wilkie (Lighting Superintendent, Leicester), and a sub-committee, consisting of Messrs. Liberty, Langlands, and Cooper, was appointed to draw up articles of association, by-laws, &c.

Institution of Electrical Engineers.—Informal Meetings.—The following informal meetings will be held at the Institution at 7 p.m.:—

November 5th, "Engineering Training," discussion to be opened by Mr. A. Russell, M.A., D.Sc. (president).

November 19th, "Power in Telephone Exchanges," discussion to be opened by Mr. A. B. Eason.

December 3rd, "Electrical Apparatus for the Deaf," discussion to be opened by Mr. C. M. R. Balbi.

Institution of Engineers-in-Charge.—The President-elect, Mr. T. Cooper, M.A. (Cantab.), M.Inst.C.E., M.I.Mech.E., M.I.E.E., will deliver his address on October 10th, at 7.30 p.m. The subject will be "Engineering Records and their Value to the Engineer-in-Charge." The chair will be occupied by the retiring President, Doctor Hele-Shaw.

The Institute of Metals.—The Institute has issued its programme of meetings and lectures for the 1923-24 session. Over thirty lectures and addresses are to be given before the local sections in Birmingham, Glasgow, London, Newcastle-on-Tyne, Sheffield and Swansea, as well as at meetings at the parent Institute, one of the latter including a lecture by Dr. F. W. Aston, F.R.S., which is to form part of the proceedings of next year's Empire Congress of Mining and Metallurgy. The subjects of the lectures include "Metals for Lamp Manufacture," "X-Rays and Metallurgy," "Alloys for use with Superheated Steam," and "Electric Resistance Furnaces."

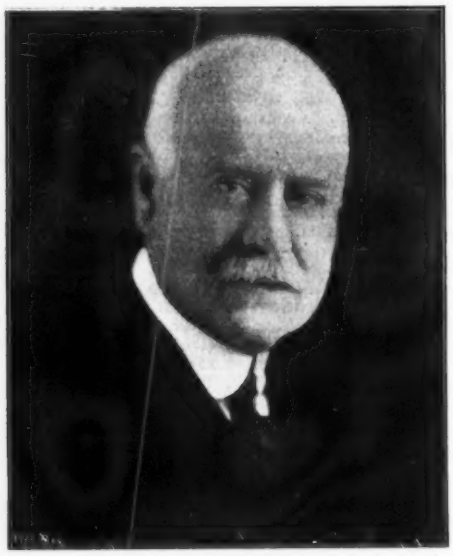
Birmingham and District Electric Club.—The Club held its first meeting of the autumn session on September 28th, when Major A. M. Taylor, M.I.E.E., lectured on "Underground Cables for High-pressure Supply." He believed that the limits in mere size of cables had already been reached. Major Taylor gave a *résumé* of his paper read before the Institution of Electrical Engineers.

Electrical Power Engineers' Association (Southern Division).—Annual Dinner.—The fifth annual dinner to the members of the National Executive Council will be held at the Hotel Cecil, London, on Saturday, October 20th, at 5.30 for 6 p.m. Tickets (8s. 6d.) may be obtained from the local technical representative, or from the hon. secretary, Mr. P. Gordon Hieatt, 188, St. James' Road, East Croydon.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* Electrical Review *posted as to their movements.

Mr. Louis A. Ferguson.—On September 12th, some 300 Edison men assembled at the Drake Hotel, Chicago, to do honour to Mr. Louis A. Ferguson, vice-president in charge of the operation of the Commonwealth Edison Co., and to commemorate his 35 years' service with that and predecessor companies. The 300 men present had been associated with Mr. Ferguson for upwards of 10 years. At the dinner he was presented with a morocco and vellum volume containing the signatures of 1,000 men and women who have served with him for a decade or more, and with an eight-piece silver service, the gift of the signers of the book. Mr. Ferguson, who is described as one of the pillars of the central station business in America, has spent his entire business and professional life in the service of the Commonwealth Edison Co. and its



Mr. Louis A. Ferguson.

predecessors. He is 56 years of age. He graduated in 1888 with the degree of Bachelor of Science in Electrical Engineering, and entered the employ of the Chicago Edison Co. in the fall of that year. His first job—in overalls—was testing street mains in the underground department. He advanced in rapid strides successively to engineer in charge of underground construction and trouble work, electric construction and, in 1890, to the post of electrical engineer of the company, a position that gave him supervision over all electrical engineering and contracting work of the company. Mr. Samuel Insull, president of the Chicago Edison Co., appointed Mr. Ferguson to the post of general superintendent of that company in 1897. A year later he was given a similar post in the Commonwealth Electric Co., an allied organisation. In 1902 he was made vice-president of both companies. In 1907, when the companies were consolidated as the Commonwealth Edison Co., he was made vice-president. Five years later he was elected vice-president in charge of all contract, operating, construction, and electrical work of the company, the position he holds to-day. We understand that to him belongs the credit of being the first central station engineer in the United States to recommend the present system of generating three-phase alternating current with transmission lines to sub-stations containing rotaries converting the current from alternating to direct for general distribution. He was one of the pioneers of the electric vehicle industry, early recognising the importance of building up the "valley" of the power-station load by charging electric vehicles at night. Thirty-five years ago the original Adams Street station of the Chicago Edison Co. had engines generating 300 h.p. To-day the company's four major power stations generate approximately a million h.p. Similarly, in 1887, just before Mr. Ferguson entered its service, the company's capital stock was half-a-million dollars. To-day it is upwards of seventy millions. Mr. Ferguson has served two terms as president of the Association of Edison Illuminating Companies, one with the National Electric Light Association, and one with the American Institute of Electrical Engineers. He is also a lecturer on the staff of engineering schools, notably Purdue, the University of Wisconsin, and his *alma mater*, Massachusetts "Tech."

Mr. R. E. Dickinson, B.Sc., A.M.I.C.E., has resigned the position of assistant electric trains engineer with the L.M.S. Railway (L.N.W. Section), and recently sailed for Australia to take up the position of works manager of the depôt to be built at Chullora, Sydney, for the new electric rolling stock of the New South Wales Government Railways.

Mr. F. E. Hughes has resigned his position as secretary of the Manchester Electricity Department as from the 31st December next. At a recent meeting of the Electricity Committee, the resignation was accepted with much regret, and an appreciation of the services rendered by him was placed on record.

Wicklow Urban Council has appointed Mr. John Plunkett of the electricity works, Cork, as engineer of its new electricity scheme, which will come into operation immediately.

In referring to the retirement of Mr. R. H. Houghton from the Brighton Railway, *Engineering* makes the following comments:—

"For nearly fifty years the name of Houghton has been connected with the telegraphs on the Brighton Railway. The late Mr. E. J. Houghton had been the telegraph superintendent and electrical engineer for over thirty years, when he retired in October, 1909, and owing, in no small part, to his influence that line was one of the first to be equipped throughout with the block system, and had a record of 100 per cent. when the Act of 1889 was passed. He was associated, too, with Mr. Stroudley in electrical passenger communication and electric train lighting. He was succeeded by his son, Mr. R. H. Houghton, under whom considerable extensions of lock-and-block track circuits and telephones, and of electric lighting and power were effected. Mr. Houghton had also the maintenance of the electric traction equipment, installed under the direction of Sir Philip Dawson, in his charge. Under grouping this arrangement has, however, come to an end, and Mr. Houghton retired on the 31st ultimo. It is rather surprising and somewhat disappointing that the Southern Railway has not been able to retain the services of three such capable engineers as Mr. Billington, Mr. Drury—the civil engineer—and Mr. Houghton, all comparatively young men too. The only chief officer of the Brighton railway to be retained is the goods manager."

The Ilford Urban Council has decided that in future Mr. G. T. Gregory, chief technical assistant at the electricity works, shall be known as the deputy electrical engineer.

Morecambe Town Council has increased the salary of the electrical engineer by £50 per annum.

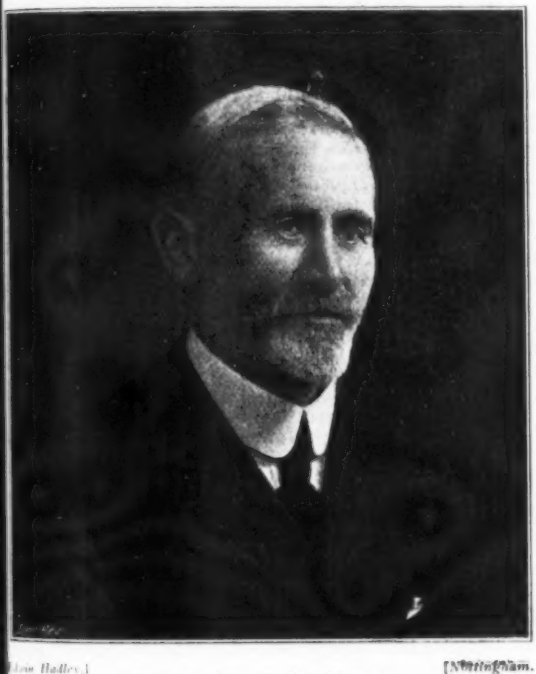
The Southampton Town Council has appointed Mr. P. J. Baker, who has been acting as manager, to be manager and engineer of the tramway undertaking, at £700 per annum.

Mr. T. M. Ainscough, O.B.E., Senior Trade Commissioner in India, is at present in this country on an official visit, and will be in attendance at the Department of Overseas Trade during October for the purpose of interviewing manufacturers and merchants interested in trade with India. Those desiring to interview Mr. Ainscough should apply (quoting the reference 4,814 T.G.) to the Comptroller-General, Department of Overseas Trade, 35, Old Queen Street, Westminster, S.W.1.

Obituary.—Mr. J. A. Phillips.—Mr. James Alexander Phillips, manager of the supply department of the British Thomson-Houston Co., Ltd., whose death it was our sad duty to record in our last issue, was a King's College man, he having obtained a scholarship there. After studying engineering he served an apprenticeship course with a London engineering company, and later joined the British Alizerine Dye Works. After further study in engineering at a London college, where he obtained a diploma in electrical engineering, he joined Messrs. Crittals, Ltd. Among other work for which he was responsible may be mentioned the installation of electric lighting and power upon the estates of Ingestre, Welbeck, and Balmoral Castle. In March, 1899, he joined the British Thomson-Houston Co., Ltd., and remained with that company till the time of his death, a period of nearly 25 years. He had four sons, one of whom was killed in France during the war. Mr. Phillips was a very popular B.T.H. official, and he was a prominent man in the councils of the British Electrical & Allied Manufacturers' Association. Among those present at the funeral, which took place on Thursday, September 27th, at Milverton Cemetery, Leamington, were Messrs.

L. K. Phillips, K. McN. Phillips, M. F. Phillips (sons); Mr. Frank Broadbent (representing the B.E.A.M.A.); also Messrs. E. G. Batt and W. Diment (representing the B.E.A.M.A. Dynamo and Motor Section); a large number of directors and staff of the company, including Messrs. H. C. Levis, W. C. Lusk, F. Fraser, H. N. Sporborg, R. Dumas, A. R. Everest, and many others. There were many floral tributes, including those from the board of directors of the company; the commercial managers; branch office managers; works management; London office staff; supply department; export and traction department; contract department; advertising and publication departments; engineering department and drawing office; and works foremen.

Mr. J. W. Ullett.—By the sudden death of Mr. John William Ullett, of Nottingham, while bidding his wife farewell at Bournemouth West Station on the 24th ult., we have lost one of the pioneers of the telephone in this country. Mr. and Mrs. Ullett had been spending a holiday at Bournemouth and Mrs. Ullett was about to return to Nottingham in response to a telegram informing her that a relative was seriously ill. It was Mr. Ullett's intention to follow in their motor car, but while saying goodbye he suddenly collapsed and died. The deceased gentleman was 64 years of age. He was educated at the Merchant Taylors' School, London, and entered the service of The Telephone Co., London, in 1879, on the engineering side. He was engaged on the construction of the first



[Nottingham.

The Late Mr. J. W. Ullett.

telephone junction lines in London and later the first trunk lines between London and the North of England. He was also responsible for the design of much of the earliest telephone apparatus. In 1893 he laid out and took charge of the National Telephone Co.'s factory at Nottingham for the construction and repair of telephone apparatus. In order to cope with increased requirements, additional works were established at Beeston in 1901, under the direction of Mr. Ullett, construction work only being carried out there, the repair work remaining at Nottingham. Both factories were controlled by him until 1903, when the British Ericsson Co. was formed to take over the Beeston Works. Mr. Ullett was then transferred to this company as works manager, which position he held until 1918. Under his management the Beeston works were greatly extended and improved, and the position to which they have attained is largely attributable to his skill, experience and untiring efforts. During the war Mr. Ullett was a member of the Advisory Committee which equipped an empty building at Lenton, Nottingham, for the manufacture of shells. The concern was known as the Nottingham National Shell Factory. Mr. Ullett's abilities had attracted the attention of Mr. J. G. Small (ex-Mayor of Nottingham), who is the principal owner of a number of industrial concerns in and around Nottingham, and in 1919 he was engaged by Mr. Small to act as expert adviser on engineering matters in connection with these various firms. At the same time he was appointed as managing director of the Amos Tatham Needle Co., Ltd., of Ilkeston, a very old-established business which had become a subsidiary company under the control of Mr. Small. Whilst occupying this position he had extended the company's business to the Colonies and also obtained a connection with the Continent, and the loss of his services will be severely felt by the company. Mr. Ullett also acted as consulting engineer to the Jacoby Bleaching Co., Ltd., of Daybrook, Nottingham. He became an Associate of the Society of Telegraph Engineers and Electricians in 1883, and a full member of the Institution of Electrical Engineers in 1891. He was elected chairman of the East Midland Sub-Centre for the coming session. Mr. Ullett was a man of great strength of character, of considerable ability, yet entirely unassuming. He inspired an affectionate regard in all his friends, by whom his loss will be much deplored.

Mr. J. J. McMahon.—We regret to record the death, which occurred on September 28th, of Mr. J. J. McMahon, electrical engineer, since 1900, of the Manchester Corporation tramways. Before going to Manchester he had extensive experience in the United States, and at Leeds, Bristol and Coventry. He was an associate member of the Institution of Electrical Engineers, and a member of the Institution of Mechanical Engineers.

We understand that Mr. McMahon was at work until a month ago, when he was taken ill and subsequently entered a nursing home, where he passed away on Saturday morning at the age of 59 years. According to statements made in the *Manchester Guardian* by one of his colleagues, Mr. McMahon went to Manchester in 1900 during the conversion of the tramways from horse to electric traction and he was then appointed electrical engineer. The first three routes to be electrically equipped were handed over to a contractor, and Mr. McMahon acted as supervising electrical engineer for the Corporation. After that the department did all its own work, erecting and maintaining the whole of the overhead network, for the service and maintenance of which he was made responsible. All the present overhead work was made to the deceased gentleman's design.

Sir H. Babington Smith.—We regret to record the death, at the age of 60 years, of Sir Henry Babington Smith, G.B.E., C.H., K.C.B., C.S.I., which occurred on Saturday last. Sir Henry was a distinguished civil servant, who had served Britain in prominent positions in various parts of the Empire and in other countries. He came home from one of his foreign appointments in 1903 to take up the post of Secretary to the Post Office, which he held for six years. During that period, says *The Times*, he represented Great Britain at various international conferences relating to postal and telegraphic work, and in 1912 he did similar duty at the first of the radio-telegraphic conferences held in London. In 1914 he was appointed chairman of the Pacific Cable Board. In 1909 he left the Post Office to become president of the National Bank of Turkey. Creations of the war period in which he had a part were the British Trade Corporation and the British Italian Corporation. He was deputy-governor of the former until his death.

Sir Henry was chairman of the Oriental Telephone and Electric Co., Ltd., and a director of the Central London Railway Co., the Grampian Electricity Supply Co., and other concerns.

Mr. R. T. Turnbull.—In the Electrical Review for July 20th, p. 105, we recorded the death of Mr. Robert Thorburn Turnbull, M.I.E.E., in New Zealand, as the result of a motor collision on the Hutt Road. We have now received some further information, from which we learn that Mr. Turnbull was born in Wellington, N.Z., in 1865. He was educated at Wellington College, Berkshire, England, and at the Crystal Palace Engineering School. He became a pupil with Messrs. Woodhouse & Rawson in 1883, and commenced business as a partner in Thompson, Ritchie & Co. In 1891 he went out to Wellington, N.Z., for the Gulcher Electric Light Co., and was in charge of the station plant for about 12 months. The firm of Turnbull & Jones was formed in 1899. Mr. Turnbull was elected a member of the Institution of Electrical Engineers in 1898.

Mr. A. W. Heaviside.—We regret to announce the death of Mr. Arthur West Heaviside, I.S.O., M.I.E.E., which occurred on September 22nd, at the age of 79 years. We hope to refer to the deceased gentleman's career in our next issue.

Mr. A. Bateman.—The death took place, on September 22nd, of Mr. Albert Bateman, who was for some years in business as an electrician at Boston.

NEW COMPANIES REGISTERED.

H. B. (Engineers), Ltd. (192,762).—Private company. Registered September 28th. Capital, £250 in £1 shares. To acquire the business of radio, electrical, and manufacturing engineers hitherto carried on by Hutchings Bros. at 6, The Parade, Aldersbrook Road, E.12. The permanent directors are:—Mrs. H. Hutchings, 112, Wanstead Park Avenue, E.12; T. Hutchings, 112, Wanstead Park Avenue, E.12. Remuneration as fixed by the company. Registered office: 6, The Parade, Aldersbrook Road, E.12.

Electromobile Engineering Co. (West Bromwich), Ltd. (192,669).—Private company. Registered September 24th. Capital, £2,000 in £1 shares. To carry on the business of electrical, mechanical, and consulting engineers, electric light and power installers, manufacturers and repairers of all electrical and general engineering plant, manufacturers and repairers of and agents for all kinds of motors, motor vehicles, or any parts, &c. The subscribers (each with one share) are:—T. A. Nightingale, Billhay Street, West Bromwich, iron merchant; L. J. Nurse, Princes End, Tipton, merchant. The subscribers are to appoint the first directors. Qualification, £100. Secretary: L. H. Nurse. Registered office: 402, High Street, West Bromwich.

Climax Patents, Ltd. (192,675).—Private company. Registered September 25th. Capital, £1,000 in 5,000 ordinary shares of 1s. each and 600 10 per cent. cumulative participating preference shares of £1 each. To carry on the business of wireless, electrical, scientific, and general engineers, &c. The first directors are:—C. H. Stave, 182, Church Street, Kensington, W.8, electrical engineer; W. B. Medlam, B.Sc., A.M.I.E.E., 36, Hartswood Road, Wendell Park, W.12, electrical engineer; R. M. Ellis, A.M.I.E.E., 167, Widmore Road, Bromley, Kent, electrical engineer. No share qualification necessary. Registered office: 182, Church Street, Kensington, W.8.

Stella Conduit Co., Ltd. (192,659).—Private company. Registered September 24th. Capital, £30,000 in £1 shares. To take over from the Stella Conduit Co., Ltd., or its liquidator, certain works, plant, machinery, and other assets at Highfield Works, Bilston, Staffs., and to carry on the business of makers of, and dealers in metal or other conduits, tubes and fittings of all kinds, tube drawers, metal rollers, brassworkers, makers of frames and other component parts of motor and other cycles, cars, aeroplanes and airships, makers of gas, water, and electric fittings, coaters of metals, makers of alloys or renderers of metals rust-proof or proof against corrosion, &c. The subscribers (each with one share) are:—G. A. Leitch, 4, Farquhar Road, Edgbaston, Birmingham, engineer; S. Vernon, 83, Colmore Row, Birmingham, solicitor. The first directors are not named. Secretary: F. E. Francis. Registered office: Highfield Works, Bilston, Staffs.

S. B. Smith & Co., Ltd. (192,628).—Private company. Registered September 22nd. Capital, £1,000 in £1 shares. To take over the business of a hardware merchant, engineer, ironmonger, and supplier of all kinds of engineering requisites carried on by S. B. Smith at 329, High Holborn, W.C., as S. B. Smith & Co., and to carry on the same and the business of electrical engineers, manufacturers of wireless and other apparatus, &c. The subscribers (each with one share) are:—S. B. Smith, 169, Elm Park Mansions, Chelsea, S.W., engineer; Col. H. L. Cooper, "Butlers," St. Mary Bourne, Hants. S. B. Smith is the first life director. Registered office: 10, Savoy Street, Strand, W.C.

Aberayron and District Electricity Supply and Power Co., Ltd. (192,742).—Private company. Registered September 27th. Capital, £3,000 in £1 shares. To adopt an agreement with Elizabeth G. Richards for the sale of the business carried on by her as the "Aeron Valley Electricity Supply Co.," and to carry on at Aberayron and elsewhere in Cardiganshire the business of an electric light company. The permanent directors are:—T. E. Richards, "Llyswen House," Aberayron, Cardiganshire, electrical engineer; Elizabeth G. Richards, "Llyswen House," Aberayron, Cardiganshire, electricity works proprietor. Registered office: Electricity Works, Aberayron, Cardiganshire.

Bishopton Electricity Supply Co., Ltd. (12,843).—Registered in Edinburgh September 22nd. Capital, £100 in 1s. shares. To carry on the business of contractors for the supply and distribution of electricity in Bishopton district, parish of Erskine, Renfrewshire, and elsewhere. Minimum cash subscription, 7 shares. The first directors are:—H. Wilson, "Lilyvale," Bishopton, Renfrewshire, builder; J. Needham, "Point House," Bishopton, Renfrewshire, coal exporter; R. C. Craig, "Wordlands," Bishopton, Renfrewshire, engineer; A. Frew, "Duncraggan," Bishopton, Renfrewshire, civil engineer; J. Blair, "Ardmore," Bishopton, Renfrewshire, solicitor. Registered office: 94, Hope Street, Glasgow.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

D. H. Bonella & Son, Ltd.—Deposit on September 10th, 1923, of deeds (without instrument) of 46 and 48, Osnaburgh Street, W., to secure all moneys due or to become due from the company to the National Bank.

Fellows Magneto Co., Ltd.—Deed of agreement and charge on certain freehold land and premises in Willesden dated May 7th, 1923, to secure certain moneys in respect of sewer rate. Holders: Royal Agricultural Society of England. (Registered September 13th, pursuant to Order of Court.)

Reason Manufacturing Co., Ltd.—Satisfaction (1) in full on July 18th, 1914, of mortgage dated December 29th, 1911, securing £1,000; (2) in full on January 20th, 1919, of mortgage dated March 21st, 1906, securing £2,000; and (3) to the extent of £650 on August 10th, 1923, of mortgage dated November 11th, 1892, securing £1,300.

Irradiant Lamp Works, Ltd.—H. Wrette-Smith, of 69 and 70, Broad Street Avenue, E.C., was appointed receiver on September 1st, under powers contained in debenture dated January 29th, 1923.

Fuller's United Electric Works, Ltd.—Particulars filed of £260,000 income debenture stock, authorised by resolution of May 25th, pursuant to Order of Court dated January 30th, for the purposes of reconstruction and covered by trust deed dated September 6th, 1923, charged on the company's undertaking and property, present and future (subject to £200,000 first mortgage debenture stock created May 17th, 1923), the whole amount being now issued. Trustees: Brig.-Gen. H. A. Jones and H. C. Merrett.

"Le Transformateur" Société Anonyme (2,259).—Particulars were filed on September 25th, 1923, pursuant to Section 274 of the Companies (Consolidation) Act. The capital is fr. 2,000,000 in 100-fr. shares. The company was incorporated in France to manufacture and deal in static transformers and other electrical and mechanical plant, &c. The British address is at 25, Victoria Street, S.W.1, where Jean Léfard is authorised to accept service of process and notices on behalf of the company. The directors are:—V. Sastene, Courbevoie; J. Rouver, Rouen; G. Unue, New York; and F. Lyzell, Le Havre.

Sanders, Kennedy & Co., Ltd.—First mortgage debenture to bearer dated September 17th, 1923, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital.

Re-Echo Electrical Manufacturing Co., Ltd.—Mortgage debenture, dated September 4th, to secure £300, charged on the company's assets, present or future, including uncalled capital, and ranking *pari passu* with a mortgage debenture dated June 4th, 1923, securing £1,200. Holder: W. Taplin, 187, Holland Road, Willesden.

E. Turner & Co. (Manchester), Ltd.—Particulars filed of £300 debentures, authorised August 21st, 1923, charged on the company's property, present and future, including uncalled capital, the amount of the present issue being £100.

R. J. Rodd, Ltd.—Issue on September 10th, 1923, of £500 debentures, part of a series already registered.

Holborn Radio Co., Ltd.—Particulars filed of £243 debenture, authorised August 25th, 1923, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

A. V. James, of 30, Elm Grove, Crouch Hill, N.8, was appointed receiver and manager on September 24th, under powers contained in debenture dated August 25th, 1923.

Ormskirk Electric Supply Co., Ltd.—Satisfaction in full on August 1st, 1923, of debentures dated August 25th, 1913, securing £2,300.

Technical Instrument Case Manufacturing Co., Ltd.—Mortgage debenture, dated September 4th, 1923, to secure £250, charged on the company's assets, present or future, including uncalled capital. Holder: Mrs. A. M. Lalonde, Smedley's Hydro, Matlock, Derby.

Aeradio, Ltd.—Issue on February 3rd, 1923, of £250 debentures, part of a series already registered.

Spencers (Electrical), Ltd.—Debenture dated August 31st, 1923, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: C. H. Fox, "Pawslade," West Green, Harpley, Whitney, Winshfield, Hants.

Whitstable Electric Co., Ltd.—Issue on September 7th, 1923, of £2,000 debentures, part of a series already registered.

H. T. Boothroyd, Ltd.—Supplementary memorandum of deposit on September 11th, 1923, charged on land and premises in Akenside Street, Bootle, Liverpool, to secure all moneys due or to become due from company to Union Bank of Manchester, Ltd.

Electric Construction Co., Ltd. (39,392).—Return dated June 26th, 1923. Capital, £400,000 in 100,000 preference and 300,000 ordinary shares of £1 each. 62,780 preference and 300,000 ordinary shares taken up. £1 per share called up on 36,480 preference and 80,000 ordinary. £116,480 paid. £246,280 considered as paid on the remainder. Mortgages and charges, £143,170.

Crowther & Osborn, Ltd.—H. Terras, of 64, Cross Street, Manchester, was appointed receiver on September 21st, 1923, under powers contained in first mortgage debenture dated September 29th, 1921.

CITY NOTES.

Still Engine Co., Ltd.

Major C. H. L. Cazalet, D.S.O. (vice-chairman) presided at the annual meeting on September 27th, and in presenting the report and accounts, said that the total amount of debentures issued was £46,440, and a total of 51,020 "A" shares had been issued. The working expenses had been considerably reduced, and the directors had continued to forgo their fees until the position of the company warranted their payment. The report of the company's technical committee showed that the Still engine could beat the best marine internal-combustion engine at present on the market, not merely in economy, but also on every other count of importance, namely, prime cost, cost of upkeep, weight, space occupied, facility of handling, safety at sea, and manœuvring under all conditions.

The company had ten licensees, covering all four branches (marine, stationary, locomotive, and road traction); these were all firms of standing who had undertaken heavy financial obligations, which proved their faith in the Still engine.

The directors were confident that the company was actually at the dawn of great success, and the chairman, therefore, appealed for the subscription of the small amount of additional capital which would enable them to reap the harvest to which their courage and patience had entitled them.

Alderley and Wilmslow Electric Supply, Ltd.

The report just issued states that the total lamp connections for the year ended December, 1922, increased from 1,530 kW to 1,630 kW. There was a gross profit of £7,244, compared with £5,238 for 1921. After deducting £1,154 interest on debentures and loans, £1,000 preference share dividend, £2,400 provision for depreciation and renewal of plant, and £400 provision for income tax, and adding £679 brought forward, there was a balance of £2,969, out of which a dividend is being paid on the ordinary shares at the rate of 8 per cent. per annum free of tax; £1,000 is put to general reserve fund, and £744 is carried forward.

East Anglian Electricity, Ltd.

The annual meeting of the company was held at Ipswich on September 19th. In presenting the report (which was reviewed in our issue of September 21st, p. 436), the chairman (Mr. W. R. Bradbrook) said that although the offer of preference shares did not meet with the hoped-for response from the shareholders, and in spite of difficult industrial conditions, the company had made satisfactory progress. During the year 561 additional consumers had been connected, and the sales of energy had increased by 150,000 kWh.

Arrangements had been made to increase the company's financial resources and facilities, and Lt.-Col. H. W. Woodall and Mr. S. F. Hawley Edwards had been appointed to the Board. The proposed abolition of the rebate granted to shareholder-consumers was referred back to the directorate for further consideration, and the report and accounts were adopted.

Victoria Falls and Transvaal Power Co., Ltd.

The directors report that after providing for interest on debentures for the year ended December, 1922, amounting to £149,287, and for depreciation and income tax, &c., amounting to £380,046, there remains £207,596 as net profit, plus £90,408 brought forward, making £298,004.

Two dividends each of 3 per cent., less income tax, on the preference shares, paid in July, 1922, and January, 1923, absorbed £88,458, leaving £209,546. In respect of this surplus the directors in June, 1923, declared a dividend of 8 per cent., less income tax, on the ordinary shares for the year.

1922, and as the preference shares are entitled to share *pro rata* with the ordinary shares in the surplus profits distributed until the preference shares have received a total dividend of 10 per cent. for the year in respect of which the distribution is made, the directors also declared at the same time a further and final dividend of 4 per cent., less income tax, on the preference shares in respect of the year 1922. The above dividends were paid in July, and absorbed £118,000, leaving a balance to the credit of the profit and loss account of £9,546, which will be carried forward.

Prospectus.—*Lancashire Electric Light and Power Co., Ltd.* A prospectus was published during this week offering for subscription an issue of 350,000 7 per cent. cum. participating preference shares of £1 each at 25s. per share, and 1,750,000 ordinary shares of £1 each at 21s. per share. The money is required to enable the company to pay off its prior lien debenture stock and first mortgage debenture stock and for the general purposes of the company. The results of the last five years' working appear in the prospectus, and it is stated that the figures for the past eight months indicate that the net earnings for 1923 of the Power Co. should be at least £10,000 in excess of those of last year. The list closed on Wednesday.

Stock Exchange Notices.—The undermentioned have been ordered to be officially quoted:—

Madras Electric Supply Corporation.—94,000 ordinary shares of £1 each, fully paid, Nos. 232,801 to 326,800.

Lima Light, Power, and Tramways Co.—Scrip, fully paid, for £1,250,000 6 per cent. first mortgage debentures.

Pennsylvania Water and Power Co.—12,743 shares of 100 dol. each of capital stock.

Application has been made to the Committee to allow the following to be officially quoted:—

Howard and Bullough.—250,000 ordinary shares of £1 each, fully paid, Nos. 1,000,001 to 1,250,000.

Zurich Bank for Electrical Undertakings. — A new scheme of reorganisation will be proposed by the directors of the Bank fur Elektrische Unternehmungen, of Zurich, at the forthcoming general meeting. On the assumption that the account of "uncovered differences in exchange" can be redeemed through the adoption of the scheme of reorganisation, the directors recommend the distribution of a dividend at the rate of 30 fr. on the preference shares, less the tax on coupons.

Russian Electro-Credit Company. — The Russian Council of Labour and Defence has sanctioned an increase in the share capital of the Electro-Credit Company of 500,000 to 2,000,000 gold roubles. The new shares are to be exclusively subscribed for by State, co-operative, and public institutions. Alterations have been made in the statutes of the company under which State organisations are to hold 51 per cent. of the share capital, while electrical manufacturing undertakings are able to hold the balance.

Montreal Tramways Co.—According to the *Financial News* the accounts to June 30th show net income $548,033, out of which have been distributed four quarterly dividends of 2½ per cent. each. $844,893 was brought in, and after appropriating $400,000 for reserve, the general surplus carried forward is $592,979.

Midland Electric Corporation for Power Distribution.—Interim dividend at the rate of 10 per cent. per annum, less tax, on the ordinary shares.

General Electric Co., U.S.A.—Quarterly dividend of 2 per cent. on the common stock and a dividend of 15 c. per share on the special stock; also 5 per cent. in special stock.

Stothert & Pitt, Ltd.—Dividend of 5 per cent., free of tax, on the ordinary shares for the year.

Bell's United Asbestos Co., Ltd.—Interim dividend on the ordinary shares of 6d. per share, less income tax.

STOCKS AND SHARES.

Tuesday Evening.

October started off well in the Stock Exchange. Business has been tolerably active in a good many markets. The House reckons to make its living between October and April inclusive. The remaining months of the year provide, as a rule, not much more than bread-and-butter business. The third quarter of the year has turned without there being any hint of dearer money. From the manner in which purely investment stocks are being absorbed, it is clear enough that capital continues to seek the Stock Exchange in default of more profitable outlets for its employment elsewhere.

The electricity supply share market is strong, and there is a steady amount of investment trade being transacted in cable stocks. Adding to the various lists of prices and yields given in this column of late, we may mention some of the preferences that are actually available and on offer in the market at the present time. The supply is none too plentiful, and brokers find that their clients are eager enough to obtain any sound shares which pay 6 per cent. or thereabouts on the money. Marketability has to be taken into account. Shares less familiar than others to the general public usually stand at a lower price, and provide, therefore, better interest on the money.

Preference.	Rate %	Div. payable.	Price.	Yield.
City of London Elec. 2nd. ...	8	M. & S.	20/-xd.	£5 6 6
Electric Supply Corp. ...	6	J. & J.	par.	6 0 0
General Electric "B." ...	7½	J. & D.	24/-	6 10 6
Lancashire Electric	7	Jan. & O.	24/6	5 14 0
Midland Counties Elec. ...	6	M. & S.	2d. pm.xd.	5 18 6
Shropshire, Worc. & Staffs...	6	M. & S.	21/-xd.	5 14 6

For some time past an issue has been expected from the East African Light & Power Company, and preliminary details are available to the effect that 200,000 ordinary shares of £1 each are to be offered. There is to be a simultaneous issue of the prospectus in this country and in East Africa. Another newcomer in the near future may be an electric lighting scheme from one of the Indian municipalities and, closer to home, there is some talk of a possible issue of shares in connection with a company for developing light and power in East Anglia. Amongst new issue prices, Tokio sixes have steadied in the neighbourhood of 87½ for the fully-paid scrip, which is equivalent to 6¼ discount upon the issue price of 94. In the above list, attention may be drawn to the Midland Counties 6 per cent. preference shares. These have been rather overlooked in the hunt for a good-class investment. The ordinary rose the other day, from 19s. 3d. to 20s. 9d. on anticipations of an increase in the previously-paid 5 per cent. dividend, but the preference are neglected.

Although Mexican utility issues have been so disappointingly slow in responding to the altered state of affairs caused by the recognition of Mexico by the United States, interest still flickers in the Mexican Light & Power and Mexico Tramway issues. With regard to the first-named company, attention is fixed upon the expectation that the company may be able to start paying off some of its 37½ per cent. arrears on the second mortgage 50-year bonds. Of these, there are a million pounds sterling issued, upon which the current interest is being met. The arrears will have to be dealt with sooner or later, and, taking the present price of 86, it is reckoned that the 37½ per cent. of arrears is worth about 28 per cent., allowing for tax, which would have the effect of bringing down the price to the neighbourhood of 58 ex dividend, provided, of course, that the arrears were discharged. Without making any allowance for this, the yield on the bonds is £5 16s. 3d. per cent. The company's 5 per cent. first mortgage gold bonds at 67 pay 7½ per cent. on the money, the difference in favour of the seconds being accounted for by the fact of the latter having the arrears still to come. Next year, all being well, the company ought to be able to start upon dealing with part of the back interest.

Mexican Light & Power 7 per cent. cumulative preferred shares, now at 55¼, have received no dividend since November, 1913, so they carry 70 per cent., less tax, of accumulated dividend, which, if not paid in cash, will have to be dealt with in some way or other in the future. Mexico Tramways 5 per cent. first mortgage bonds stand at 76½, and pay six guineas per cent. on the money. Nothing has been paid on the Tramways 6 per cent. 50-year mortgage bonds since July, 1914.

Charing Cross ordinary are again 10s. higher at 12½, Chelseas have jumped 3s. to 38s., City Lights are better at 50s. 7½d., and South Londons improved to 38s. 9d. Westminsters are better at 10½. The whole of the market is strong, and the improvement has extended to shares in the provincial list. Of these, Bournemouth & Poole ordinary are active in the advanced neighbourhood of 37s. 6d., the buying coming largely from local sources. Interest waits with lively attention upon the re-assembling of the London County Council, because it is expected that, in the new session, steps will be taken that are likely to eventuate in the London electricity supply companies receiving an extension of forty years to their present life. As things are now, the term runs out, in most cases, in 1931, but it is hoped that this will be dated forward to 1971. Nearly all the leading companies have been putting away large sums to reserve against the time when it might be necessary to make a return to their shareholders, and, if the extension of tenure is carried through, then will arise the question of what shall be done with these reserve funds.

Applications are being invited for 8 per cent. preference shares and 7 per cent. first mortgage debentures in the Wareham Electric Supply Co., Ltd. We have had something to say about this concern on a previous occasion, and need only repeat that people with money will be well advised to put their capital into something safer.

The Home Railway market is a little reactionary, though Underground ordinary £10 shares have risen to 3¼. Metropolitans and Districts, however, are both a trifle lower, but there is not much doing in this section at the moment. British Columbia Electric deferred, after its rise to 100, has gone back to 97½. Brazil Tractions are a point down, and Anglo-Argentine Tramways first preference reacted to 58s. 9d.

Brush ordinary shares remain at 25s.; General Electric preference are a little harder at 23s. India Rubber shares have fallen 1s. 3d. to half-a-sovereign. The miscellaneous market as a whole is quiet, with little going on, and in the engineering group conditions are uninteresting. Babcocks drooped to 45s. Rubber shares have gone back a shade, but the market is arousing no particular attention. Something of a feature amongst South Africans is a rise in Victoria Falls ordinary to 28s. 3d., the company's preference shares also being harder at the same price.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Nom.	Dividend. 1921.	Dividend. 1922.	Price Oct. 2, 1923.	Rise or fall.	Yield p.c.
	£					
Brompton Ordinary	1	12	12	2 1/16	—,	£5 16 8
Charing Cross Ordinary	5	9	14	12½	+ ½	5 12 0
do. do. do. 4½ Pref.	5	4½	4½	4¼	—	5 6 0
Chelsea	1	6	10	38/-	+3/-	5 5 3
City of London	1	14	15	2 17/32	+ 1/16	5 19 1
do. do. 6 % Pref. ...	1	6	6	24/-	—	5 4 4
County of London	1	8	10	2 3/32	—	4 15 6
do. do. 6 % Pref. ...	1	6	6	23/3	—	5 3 3
Edmundson's Ordinary	3	Nil	7	8½	—	6 0 5
do. 6 % Pref	5	12/-	6	4¼	—	6 8 1
Kensington Ordinary	6	10	12	9½	—	6 1 6
London Electric	2	4	10	4¼	+ ¼	6 3 3
do. do. 6 % Pref. ...	5	6	6	5¾	—	5 11 7
Metropolitan	1	7	8½	1¾	+ 1/32	5 4 7
do. 4½ % Pref.	1	4½	4½	17/-	—	5 6 0
Newcastle-on-Tyne Ordinary ...	1	Nil	2½	17/-	—	2 18 10
do. 5 % Pref. ...	1	5	5	15/9	—	6 7 0
do. 7 % Pref. ...	1	7	7	23/-	—	6 1 9
Notting Hill 6 % Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6 % Pref. ...	1	6	6	22/-	—	5 9 1
Urban Ordinary	1	Nil	—	15/-	—	Nil
do. 5 % Pref. ...	1	2½	5	¼	—	6 17 0
James' and Pall Mall ...	5	12	14½	11¾	—	6 3 5
South London	1	7	10	1 1/16	+ 1/16	5 8 3
South Metropolitan Pref. ...	1	7	7	24/6	—	5 14 3
Westminster Ordinary	5	10	12	10½	+ ¼	5 17 1
Whitehall Elec. Invst., 7½ % Pf.	1	7½	7½	1	—	7 10 0

Home Rails.

Central London Ord. Assented	Stock	4	4	73	—	5 9 7
Metropolitan	,,	2½	3½	76¼	— ½	4 11 6
do. District	,,	1	3	53½	—1	5 12 1
Underground Electric Ordinary	10	Nil	Nil	3¼	+ ¼	Nil
do. do. "A" ...	1	Nil	Nil	9/6	—	Nil
do. do. Income Bonds	4	5	99	—	*5 1 0	

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	102½	—	5 17 1
do. Def.	,,	1½	34/6	23	—	6 9 0
Chile Telephone	5	6	6	6	—	5 0 0
Cuba Sub. Ord.	10	7	7	7½	—	9 6 8
Eastern Extension	10	10	10	17¾	+ ¼	5 12 8
Eastern Tel. Ord.	Stock	10	10	175½	—	5 14 0
Globe Tel. and T. Ord.	10	10	10	17½	—	5 14 3
do. do. Pref.	10	6	6	11¼	—	5 7 7
Great Northern Tel.	10	24	22	27½	+ ½	8 0 0
Indo-European	25	10	7	32½	—	5 7 8
Marconi	1	25	15	2½	— 1/32	6 13 4
Oriental Telephone Ord. ...	1	12	12	1½	—	*6 8 9
United R. Plate Tel.	5	8	8	6¾	—	*5 16 6
West India and Panama ...	10	Nil	Nil	1/6	—	Nil
Western Telegraph	10	10	10	17¾	+ ¼	*5 15 0

Home and Foreign Trams, &c.

Anglo-Arg. Trams. First Pref.	5	6½	12½	2 13/32	— 1/32	9 7 2
do. do. 2nd Pref.	5	Nil	6½	2 3/32	—	11 17 10
do. do. 5% Deb.	Stock	5	5	75½	—	6 12 5
British Electric Traction Ord.	,,	4½	5	73½	—	6 16 1
do. do. 6% Pref.	,,	6	6	100½	—	5 19 3
Brazil Tractions	100	Nil	4	46	—1	8 14 0
Brit. Columbia Elec. Rly. Pref.	Stock	5	5	87½	—	5 14 3
do. do. Preferred	,,	5	9/-	86	—	*5 12 0
do. do. Deferred	,,	8	127/-	97½	—2½	*6 10 0
do. do. Deb. ...	,,	4½	4½	79½	—	5 7 0
Lond. & Sub. Trac. 5 % Pref.	1	9½	5	9/-	—	11 2 0
London United Tram. Deb. ...	Stock	4	4	60½	—	6 12 3
Mexico Trams. 5 % Bonds ...	—	Nil	Nil	76½	+1½	6 10 9
do. 6 % Bonds ...	—	Nil	Nil	55½	—1	Nil
Mexican Light Common ...	100	Nil	Nil	28	—	Nil
do. Pref.	100	Nil	Nil	55½	—	Nil
do. 1st Bonds ...	—	Nil	5	68½	—	7 10 3

Manufacturing Companies.

Babcock & Wilcox	1	15	20	2½	— 1/32	*4 9 1
British Aluminium Ord. ...	1	10	5	18/9	—6d.	5 6 8
British Insulated Ord.	1	15	15	2½	—	6 0 0
Callenders	1	15	15	2⅝	—	6 6 4
do. 6½ Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	10	5	7/8	—	8 17 6
Edison-Swan	1	10	Nil	4/6	—	Nil
do. do. 5% Deb.	Stock	5	5	65	—	7 13 10
Electric Construction	1	10	10	1 1/16	—	6 16 1
English Electric	1	8	5	17/3	—	5 16 0
do. do. Pref.	1	6	6	19/-	—	6 6 4
Gen. Elec. Pref.	1	6½	6½	23/-	+3d.	5 13 3
do. Ord.	1	10	5	19/3	—	5 4 0
Henley	1	15	15	2⅝	+ 1/16	6 6 4
do. 4½ Pref.	5	4½	4½	4⅜	—	5 2 10
India-Rubber	1	10	—	10/-	— 1/16	—
Met.-Vickers Pref.	2	8	8	2½	—	6 8 0
Siemens Ord.	1	10	10	½	—	Nil
Telegraph Con.	12	20	20	25	—	*5 0 0

* Dividends paid free of Income Tax.

MARKET QUOTATIONS FOR CHEMICALS AND METALS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

CHEMICALS, &c.		Price Oct. 3rd.	Fortnight's Inc. or dec.
a Acid, Oxalic	per lb.	6d.	½d. dec.
a Ammoniac, Sal	per ton	£60	...
a Ammonia, Muriate (large crystal)	,,	£52	...
a Bisulphide of Carbon	,,	...	...
a Borax	,,	£25	...
a Copper Sulphate	,,	£25 10s.	...
a Potash, Chlorate	per lb.	4d. to 4½d.	...
a ,, Perchlorate	,,	4d.	...
a Shellac	per cwt.	£16	20/- inc.
a Sulphur, Sublimed Flowers ...	,,	£8 10s.	...
a ,, Roll	,,	£8	...
a Soda, Chlorate	per lb.	3d.	...
a ,, Crystals	per ton	£5 10s.	...
a Sodium Bichromate, casks ...	per lb.	4½d.	...
METALS, &c.			
b Aluminium, Ingots	per ton	£115 to £120	...
b ,, Wire	per lb.	1/9 to 2/6*	...
b ,, Sheet	,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—			
Grade I	per ton net	£188	£3 inc.
Grade II	,, ,,	£133	£2 inc.
Grade III...	,, ,,	£74	£1 inc.
c Brass (rolled metal 2" to 12" basis)	per lb.	9½d.	½d. dec.
c ,, Tubes (solid drawn) ...	,,	11¾d. to 1/0	½d. dec.
c ,, Wire, basis	,,	10½d.	...
c Copper Tubes (solid drawn) ...	,,	1/1½d.	½d. dec.
c ,, Bars (best selected) ...	per ton	£94	£2 dec.
c ,, Sheet	,,	£94	£2 dec.
c ,, Rod	,,	£94	£2 dec.
d ,, (Electrolytic) Bars ...	,,	£67 5s.	20/- dec.
d ,, ,, Sheets ...	,,	£145 10s.	...
d ,, ,, Wire Rods ...	,,	£77 5s.	20/- dec.
d ,, ,, H.C. Wire	per lb.	9¼d.	½d. dec.
f Ebonite Rod	,,	3/6	...
f ,, Sheet	,,	3/-	...
n German Silver Wire	,,	2/3	...
h Gutta-percha, fine	,,	6/6	...
h India-rubber, Para fine	,,	1/2	1d. dec.
l Iron Pig (Cleveland Warrants) ...	per ton	£5 2s. to £5 2s. 6d.	...
l ,, Wire, galv. No. 8, P.O. qual.	,,	£25	...
g Lead, English Pig	,,	£27 10s.	15/- inc.
g Mercury	per bot.	£9 5s. to £9 10s.	10/- to 15/- inc.
e Mica (in original cases) small ...	per lb.	3d. to 3/-	...
e ,, ,, medium...	,,	4/- to 8/-	...
e ,, ,, large ...	,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings	,,	1/2	...
p ,, drawn bars and rods	,,	1/3½	...
p ,, rolled strip & sheet	,,	1/3½	...
p ,, wire	,,	1/3½	...
o Platinum	per oz.	£25	...
d Silicium Bronze Wire	per lb.	1/1	...
r Steel, Magnet, in bars	,,	10d.	...
a Tin, Block (English)	per ton	£202 to £202 5s.	£3 inc.
n ,, Wire, Nos. 1 to 16 ...	per lb.	3/-	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
l Bolling & Lowe.
n Richard Johnson & Nephew, Ltd.
o P. Ormiston & Sons.
p Johnson, Matthey & Co., Ltd.
r C. Clifford & Son, Ltd.
s W. F. Dennis & Co.

The Design of Large Incandescent Lamps.—The progressive advance in the efficiency of electric lamps since the first metal-filament lamp was introduced is a matter of common knowledge. But an even more remarkable fact is the great increase in range of candlepower, which is continually extending upwards. Lamps consuming up to 1,500 watts, and furnishing over 25,000 lumens (approx. 2,000 mean spherical c.p.) are now listed, though it is only very rarely that such high candle-powers are necessary in practice. Even bigger lamps, consuming about 4 kW, and credited with approximately 8,000 max. c.p., have been designed for lighthouse work. But it is probable that even this does not mark the limit. Some interesting information on this point was given in a recent contribution by Mr. P. G. Nutting to the *Journal* of the Optical Society of America. Amongst other matters he mentions the use of tungsten ribbon 0.1 mm. thick, having a surface like a mirror, as likely to lead to a considerable improvement in efficiency. It is also stated that the production of 10-kW and 30-kW coiled-wire radiator lamps is now well through the development stage and that a giant lamp to consume 100 kW has been designed, but has not yet been constructed.

Russian Workers' Power Station.—We are informed that the president of the Supreme Economic Council, having heard the report on the starting of the 1,000-h.p. power station at the Bondyurh chemical factory, built since the revolution, registers the success and congratulates the Revolutionary Proletariat of the Bondyurh factories on this fresh feat. The active spirits in the construction of the station were the mechanic I. P. Vizitoff and the workmen Nartinoff and Kassonoff, who have been awarded the title of Labour Heroes (Heroyeff Truda).

ON VISITING LONDON IN THE AUTUMN.

By J. W. BEAUCHAMP, Director of the British Electrical Development Association, Inc.

In the next three months many engineers and others interested in the electrical industry will be brought to London from the provinces or to its centre from the suburbs by reasons of business.

The time is over when the evenings could be spent in the parks or on the river, and the lure of the lighted centres is more likely to attract the stroller, who, however, may easily miss objects of the greatest interest to him through unfamiliarity with their position and on account of the rapid manner in which electrical displays grow and change from season to season.

Unfortunately many visitors from the provinces are obliged to hurry through their business and back again, but occasionally a real effort should be made to secure a few days in Town with no other object than a general look round amongst the trade showrooms, visits to manufacturers or supply engineers doing interesting work, and inspection of lighting at night.

It is invidious to make distinctions between business districts but, addressing those who look upon shop-window layouts and lighting from the point of view of technical or advertising interest rather than the purchase of goods, one may pick the thoroughfare between Tottenham Court Road and the Marble Arch, Regent Street and Piccadilly, with the sign-lighting centre around Piccadilly Circus, not perhaps forgetting Bond Street, as the best of London's shopping district.

Some of the outlying suburbs to-day boast of fine shopping areas, second only to the West End, but these are not likely to appeal to the provincial visitor on account of distance.

Later Lighting.

The practice of leaving window displays lighted after closing hours is spreading rapidly; it is a great aid to business and lends brightness to the street, but it is not yet so general that one can rely upon it for the study of shop-lighting practice; it is necessary that the little tour should be started immediately before dusk at the present time of the year in order to catch the displays before dark gaps appear by the closing of shops.

Immense progress has taken place in the lighting of windows, a progress not brought about by wasteful use of electrical energy, but by scientific methods and the variety of new fittings now obtainable.

The advertising influence of electric lighting on retail business must be very great; attractiveness and colour scheme value are so much increased, and the way in which electricity, wisely used, co-ordinates with the artistic work of the window-dresser must be seen to be appreciated.

Every Shop a Stage.

Along the routes mentioned there are many novelties, the use of colour lighting, the help of the scene painter, the strong contrast of light and shade, rendering the best windows as little "stages" of a silent and motionless play so bright and arresting that unconsciously one awaits some entry or event.

Within the industry there is at present a revival of interest in lighting, taken rather too much for granted in recent years and allowed to progress by its own momentum.

Wembley.

The Wembley Exhibition, opening in a few months' time, will give a great impetus to the use of electricity. The rather dramatic proposals for lighting already described in the Press will prove one of its greatest attractions, and we shall probably be able to say that the electric lighting was the Exhibition's greatest charm and accounted for gate money many thousand times greater than the cost of the work involved.

Light and Safety.

There is yet much to do in the street lighting of London, although in many districts fine examples are to be seen. Attention has been given to the lamp and its fittings, but the need of the hour is collaboration between street lighting superintendents, traffic management, police, and the electrical engineers; a wider study of the lighting problem as such, the grading of light as between the main thoroughfare and the side street, varying of light intensity in streets around restaurants, theatres, and places of public resort where people are exposed for hours to lighting of a very high standard and often enough discharged in crowds late at night amongst swirling taxis and 'buses into streets where the illumination is defective.

The "Safety First" people have much of interest to say in this connection and upon frequency of accidents in relation to the time of the day or night and the character of the public lighting.

An infrequent visitor cannot fail to be impressed with the rising standard of light in connection with transport. Tramcars and 'buses are better lighted; in the former at last attempts are being made to introduce scientific lighting which will ease the work of the conductor and enable people to read during a long journey without the fatigue arising from the rows of unshaded lamps to which they so long have been accustomed.

This improvement may arise from the work of the Underground Railways combine; burrowing like moles in the dark, it has been obliged to give particular attention to artificial lighting, and to-day the illumination of its trains and corridors, together with the remarkable display of illuminated signs, is a notable example of what can be done with artificial light where no difficulty of ventilation, heating, or air pollution arises from the lighting medium employed.

Knowledge of Lighting.

The manufacturers of lamps and lighting fittings are responsible for the greatest and most valuable efforts to raise the standard of illumination.

More than one of the large firms engaged in this work are now carrying out educational activity of the highest value, spending large sums on educating users of every class in the proper employment of light in different industries, retail trades, commercial business, and in the home.

Visitors to these demonstrations are welcomed, and arrangement to see most interesting displays can readily be effected.

The lighting advertising carried out by the lamp makers in effect reacts most valuably on electrical applications generally; light is always the first use of electricity made by the consumer, and is a continuous canvasser for other ways of employing electrical energy.

The present season will give a fresh opportunity to many to see new methods of lighting in kinemas, theatres, and restaurants. The new Tivoli in the Strand and the new kinema at Shepherd's Bush may be cited as the most notable examples of the latest practice, whilst in theatres we are promised the use of colour lighting in place of elaborate scene painting and shifting.

Amongst newly-fitted restaurants one may cite the Metropole at the top of the scale, and Lyons's new Corner House in Coventry Street somewhat lower down, both very notable examples of electricity as seen in the lighting and as unseen in many applications to work, lifts, and ventilation: the manner in which the decorative scheme is tied in with the lighting and depends upon it for its effect is particularly notable.

Every public use of electric light accomplishes more than the illumination of an object, carrying with it a

distinct advertising value. In one particular application of this use of light, the advertising sign, we are always said to be behind America, and that is probably true in the bulk of display, but our examples are not to be despised, and they do keep in view the object of their existence, to sell somebody's goods; it is not difficult so to elaborate a sign as merely to produce a startling show which leaves no business message in the mind.

The lighting of advertisement hoardings is slowly making headway. This business offers great possibilities, is inexpensive to carry out and maintain, and adds immensely to the revenue-earning capacity of the hoardings.

So far we have but few examples of the "Neon" tube lighting, which has become popular in Paris in the last twelve months, probably the best and easiest to visit being the tower of the Coliseum in St. Martin's Lane.

The possibilities of this method of gala lighting are very great; it is practically invisible by day, offers no disfigurement to architectural outline, and does not suffer from the imperfections arising in elaborate lamp signs from lamp failure and the attendant expense of lamp changing.

Neon lighting is particularly beautiful in early dusk, the colouring against a sky not yet black and the glow upon surrounding buildings must be seen to be appreciated.

Those who are interested in window displays as such—and who is not at the present time?—cannot fail to notice development of this work in the electrical industry; the best of the electrical contractors' shops and some of the leading manufacturers offer particularly striking and frequently-changing pictures of electrical apparatus. There is an increasing tendency to tell the story simply and depart from the old method of showing apparatus massed in the window, carelessly or otherwise, seldom even with any statement of its purpose and cost in use, and never with any supporting illustration to carry across the idea of the comfort, convenience or economy which its employment brings about.

Some of the windows of well-known trading firms now show frequently-altered displays, and are a continuous centre of interest to the passer-by, beneficial to the initiator and to the whole of the supply undertakings of the country.

The electrical showrooms of London rather divide themselves into two classes, although often overlapping—those where a great display is made for the benefit of the trade, and those which are practically run as electrical houses, restaurants or works where the ultimate buyers can see appliances in use day by day and be "sold" on the idea behind the appliance rather than the thing itself.

These domestic showrooms and restaurants should be visited from time to time, and will be found most informative and interesting.

Their staffs seem imbued with the "Selfridge" spirit, inviting the fullest discussion and demonstration, and keeping in the background the real object of the display—the sale of appliances or food.

The visitor to London interested in electricity can to-day get his meals in restaurants where this method of cookery alone is employed, spend his winter nights in hotels where the bedrooms are warmed electrically, and generally make his visit a sort of electrical tour which cannot fail to bring home to him a thing too often forgotten—the importance of the industry in which he is engaged, and the value of his own work towards the revolutionary change which the general use of electrical energy is bringing about in our lives.

Those who are able to go more into detail and know or can secure introductions to the managements of the more advanced supply areas will find a mine of useful knowledge not yet open to all; both in the east and west of London well-known men are pioneering actively and are able now to give the result of experience of hard work in electric cookery, heating, and the latest attacks on the great stronghold of coal and gas—the heating of water in bulk.

Conversation with those engaged in this work reveals all sorts of unexpected activities in the application of electric heat to industry, curious changes being brought about in industrial processes solely by the possibilities of this medium.

Much of this work is being carried out by men who have been engaged in the industry for many years; still full of hope and energy they move from success to success, building far better than they know, sometimes little but always wise; unfortunately they do not advertise.

THE GAS WORKS ELECTRICITY SCHEME: ITS FUEL COST.

By W. T. WARDALE, A.M.I.E.E.

Recent descriptions of combined gas and electricity schemes in the technical Press seem to have impressed a good many power-station engineers with the idea that the town's gas engine, as a prime mover, must necessarily have so high a fuel cost as to make it unsuitable even for the smallest localities.

This opinion is not correct, and it is proposed to give some details of the working costs of such plant, and to show where economy becomes possible, and the points at which one expense will balance with another.

Taking a gas supply concern which is supplying at a price of 4s. a thousand cubic feet, it will be found that the cost of gas at the works will be about half this amount, say, 2s. per thousand. At this price, an engine driving a directly coupled 100-kW generator would cost for fuel alone approximately 0.88d. per kW-hour, a price so high as apparently to wipe out any resultant saving which might be made elsewhere.

Details of the costs, however, will show that there is ample room for economy in two or three ways and several incidental advantages.

The gas consumption of a good-class gas engine, working on an electric lighting load, with a light power load in the daytime, may be taken as 37 cubic feet per kW-hour, making an hourly consumption when on full load of 3,700 cubic feet of gas. Taking a load factor of 11 per cent. and a yearly output of about 90,000 kWh for a station containing, say, one set of 100 kW and a light-load set of 25 kW, the total consumption of gas will be 3,330,000 cubic feet, costing, at 2s. per thousand, £333.

It is now necessary to compare the fuel costs of rival prime movers; perhaps the best to take first is the anthracite suction producer. A larger engine will be required, more floor space, more capital outlay, and special precautions against nuisance by offensive odour, or the draining of noxious fluid into adjacent streams. In addition, a man who understands and can humour a suction producer must be employed, if both continuity of service and the utmost economy of which the producer is capable are to be achieved. Like all producer plant, the suction producer will not give its best results on varying load, or short-hour working; and in the circumstances we are considering the consumption will average all the year round 2 lb. of anthracite per kW-hour. This fuel will cost in most districts £3 a ton delivered, and the cost will be £240 for 80 tons a year.

The saving in fuel costs over the town's gas is thus only £93.

It will probably be suggested that to a small concern this is a considerable item; this is granted. The saving, however, is not a net saving by any means. We have to allow for the extra cost of the engine itself, the added cost of the producer, and the value of the man's time who looks after the installation. It would also be urged by some engineers that the extra cost of repairs and cleaning should be placed against the fuel saving. Whilst this item is heavier than with the town's gas engine, I do not agree that both the cost of a special man *and* extra cleaning and repair costs should be counted against the suction plant; if the suction-gas plant attendant is worth his salt, he will carry out the whole of the valve and liner cleaning required, the clearing of the producer interior and occasional re-lining, and will, by his special knowledge of how to humour the plant, anticipate the need for cleaning and adjustment, and so avoid most of the repairs usually required with such plant run by the ordinary handy man. Such a man to-day would cost the concern at least £140 a year, and would not be worth employing if he accepted less. Thus, on one item alone, the fuel saving is quite wiped out by other and necessary items.

The next prime mover to be compared is the crude-oil engine; this can be run with almost as little attention as a town's gas engine, has practically no standby or preparation costs, takes up little space, and is exceedingly reliable. Under the same output and conditions, it will be found that such engines use approximately 0.9 lb. of oil per kW-hour. At a cost of £5 a ton delivered into the works yard, this entails 36 tons, costing £180.

Here the saving in fuel is more substantial; the balance of advantage is, however, still with the town's gas engine for this type of work. First, the object is to make it possible to supply localities remote from the coal fields, and somewhat sparsely populated, with the convenience of both electricity and gas; and to make it possible to supply electricity at a cheap rate by cutting out as much of the overhead and management charges as possible. This is accomplished by making use of the gas works plant, and hence, of the capital laid out in the gas works; if that capital is to be superseded, or to be rendered of diminished value owing to competition which cuts off half its activity, then neither the electricity nor the gas supply will get a chance to give the community the best possible service. The electricity supply will bring many loads to the gas works, such as farm motors, which it could not easily secure otherwise. This means an increased output for the gas plant, and a lower charge per ton of coal carbonised; on the other hand, the use of the oil engine would automatically take customers off the gas mains and off the gas plant altogether, throwing the gas plant more idle, and so increasing the cost of gas per thousand cubic feet. This saving will not be confined to the mere cost of carbonising a ton of coal; the added output will soon reach a point where it will pay to develop the production of residuals to a much higher degree than when the output is on a quite small basis. Thus, with an energetic man at the head of the electrical side of the business, it should soon become possible to supply the engines at a much lower rate per thousand cubic feet of gas. It would, of course, be a long time before the reduction would get down to, say, as low as 1s. 3d. per thousand cubic feet at the engine; but that figure would wipe out all the fuel saving due to the use of the oil engine. Whilst this type of engine can be run by an unskilled attendant with greater safety than is the case with a suction producer plant, yet, if the best economy is to be maintained, it would undoubtedly pay to engage a first-class fitter driver, and to use, say, one-third of his time looking to the needs of the oil engines, and the rest attending to the plant in and about the gas works, and possibly assisting to erect motors, small shafting and pulleys, for clients in the district. It is not absolutely necessary, but it would undoubtedly pay well to spend £50 a year in the manner suggested. Gas works employés have lived so long with the gas engine working on their own fuel that they can take hold of the extra necessary work on such a plant with practically no extra assistance. They do not, however, understand the oil engine to the same extent, and their lack of intimate experience would have to be paid for.

The great aim is to increase the gas plant output; and this being accomplished through the creation of a good electrical load, would enable the gas plant itself to be extended on more modern lines until, with one improvement and another, the price to the gas consumer would come down to 3s. or even less, and that to the generating engines to, say, 40 per cent. of the cost to the outside consumer.

One feature which will be urged against the scheme is that when the load increases to, say, 150,000 kWh a year, the difference in fuel cost between one prime mover and the other will be so great as to become serious; this objection is, however, ruled out by the benefits accruing from increased output; and this point will automatically take care of itself.

The question of gas or electrical cooking would not matter to the electricity undertaking or its gas forerunner; in either case the revenue would come into the one pocket, and within a quite short time the best and most convenient method would be employed for each individual case. No one would care to go back to gas lighting who had once used electricity, and here again the transfer would not be from the gas company to a rival concern, but simply from one account in the books to another.

NOTES FROM CANADA.

(From Our Canadian Correspondent.)

The *Electrical News*, Canada, recently gave some interesting statistics relating to British Columbia, of which the following are a few.

British Columbia is much better off than some of the other provinces of Canada in that it possesses great resources in metals, coal, forests, and water power; most of the other provinces have an abundance of some of these resources, but not of all.

There are 50 electric generating stations in British Columbia made up of 30 hydro-electric, 13 steam, and 7 gas or oil. The capital invested in privately-owned plant is about $42,000,000, and in municipally owned stations about $2,600,000. The sum of these two amounts represents 10 per cent. of the total capital investment of the Dominion in electrical undertakings, and places British Columbia in the third place in this respect, Ontario and Quebec leading; in British Columbia, too, about 11 per cent. of the total h.p. generated in Canada is produced.

The president of the British Columbia Electric Railway Co., in an article in the paper referred to above, states that of about 3,000,000 h.p. of hydro-electric power available in the Province only about 10 per cent. has been developed yet. He adds that the outlook for the demand for a supply of electrical power is exceedingly favourable. Mining is in its infancy, many pulp and paper mills will, it is believed, be established in the near future. Taxation is high owing to shortage of population. There is no cessation in the demand for extensions to the company's distribution system, and as evidence of its faith in the future, the company has recently spent over $1,000,000 on increasing the storage capacity available at Stave Falls, and has installed an additional 13,000-h.p. unit. There are now under consideration plans for the construction of another plant at a cost of $10,000,000, which would add another 115,000 h.p. to the present generating capacity.

The British Columbia Electric Railway Co. has invested $60,000,000 of English capital in the Province. Light, power and railway service is given on the mainland over an area of 80 miles long and 40 miles wide.

More water power is developed, *per capita*, in British Columbia than in any other part of Canada.

It is stated that 95 per cent. of the houses in Greater Vancouver use electricity for lighting, and houses are often wired long before there is any supply available in the vicinity.

It is reported that plans for the electrification of the Canadian Pacific Railway Co.'s main line heavy grades through the Rocky Mountains are being considered, and some surveys of the water power available have been made. A big power development is said to be in hand in Newfoundland.

The Newfoundland Pulp and Paper Co. is developing about 200,000 h.p., a large proportion of which will be required in a new manufacturing plant which the company is building to produce about 400 tons of paper per day. Messrs. Armstrong, Whitworth are carrying out a good deal of the work.

In Ontario, the Hydro-Electric Power Commission is extending the plant at Nipigon, which supplies Port Arthur, at the

western end of Lake Superior, with power; about 24,000 h.p. is being added. A great deal of work has been done lately by the Commission in taking power into the rural districts, and there are now about 650 miles of rural transmission lines carrying power to 93 townships.

After certain work has been carried out by the Toronto and Eastern Radial Lines, the Canadian National Railways will, it is said, electrify the line from Toronto to Oshawa, and connect with the Oshawa-Bowmanville line of the Toronto and Eastern.

In Alberta, according to the *Canadian Engineer*, survey parties are surveying the Red Deer and other branches of the Saskatchewan River for the purpose of locating suitable sites for irrigation and power purposes.

The Hollinger Consolidated Gold Mines Co. has contracted for the construction of a large dam and power house on the Abitibi River, in Northern Ontario. About 25,000 h.p. will be developed at first; it is expected that power will be available in about a year. A Diesel engine generating set will be installed for stand-by purposes. A 110,000-volt transmission line about 80 miles long will be built. Very considerable development of power is taking place just now in Northern Ontario, with prospects of still greater advance in the near future.

THE BRITISH ASSOCIATION—IV.

A Squirrel-cage Induction Motor with High Starting Torque and Low Starting Current in the Line.

By T. F. Wall, D.Sc., D.Eng.

(*Paper read before Section G.—Engineering.*)

Introductory.

One of the oldest outstanding problems in heavy-current electrical engineering is the production of a squirrel-cage motor which, whilst retaining the inherent valuable characteristics of the standard squirrel-cage motor, *viz.*: cheapness, robustness, simplicity, lack of risk of sparking at the rotor, &c., shall also have the property of developing a large starting torque without drawing an abnormally large starting current from the line.

Standard squirrel-cage motors, if started by switching directly on to the line, may develop a very good starting torque, but draw five to six times the normal full load current from the line. If large squirrel-cage motors were to be so started, the heavy initial rush of current in the line, emphasised by the low power factor, would result in large supply voltage fluctuations. In this country and on the Continent, such starting of large squirrel-cage motors is generally prohibited by the electricity supply authorities.

It is usual to start the motor by supplying a reduced pressure to the stator either by means of a special auto-transformer or by means of a "star-delta" switch. Such a reduction of the supply pressure results in a reduction of the starting torque, and to satisfy the requirement that the line current at starting shall not exceed from 2½ to 3 times the full-load current, the starting torque becomes reduced to a value considerably less than the normal full-load torque. In consequence, it is necessary to start the motor light and, by means of an automatic centrifugal clutch or other device, to couple up the load when the motor has run up to speed.

In two interesting and suggestive articles, recently appearing in the *Elektrotechnische Zeitschrift*,* the history of the development of the squirrel-cage motor is given, and also a consideration of the reasons for the preferential development in different countries of the slip-ring and squirrel-cage types respectively.

In the course of his article, L. Schueler states that the fact that the Dobrowolski patent for the squirrel-cage rotor did not expire until 1905 was a serious hindrance to the development of this type of motor by many firms, and that the prejudice against the squirrel-cage motor in Germany is largely due to the difficulties to which this patent gave rise. He further states that the European public have become accustomed to the higher cost of the slip-ring motor, and the superior running characteristics of large squirrel-cage motors are not familiar to them. Moreover, the electricity supply authorities have learnt to appreciate (from their point of view) the superior starting characteristics of slip-ring motors, and have encouraged, if not insisted on, the installation of the slip-ring type.

Many methods have been proposed and tried with a view to enabling the squirrel-cage motor to meet the competition of the slip-ring type. In particular, the double wound, squirrel-cage rotor of Boucherot has had a certain limited application. In the discussion at Liverpool on the late Dr. Kapp's paper on "The Improvement of Power Factor," Mr. C. Rettie states: "The first battleship in America fitted with electric drive had squirrel-cage induction motors, having two windings on the rotor with high and low resistance, respectively. The efficiency was so low, however, that in the other ships fitted up by the General Electric Co., of America, the system was altered, the principle being the same, but a winding on the rotor was introduced with slip-rings to raise the power-factor, the winding being cut out when the motors were up to speed." †

A discussion of the Boucherot type of motor has been given by the present writer in a recent publication‡ and the disadvantages of this type as compared with the standard squirrel-cage motor have been considered with the aid of a numerical example.

Another proposal was made many years ago by H. M. Hobart to utilise the well-known "skin effect" in iron conductors, but the method has not achieved the purpose.§

Principle of the New Type of Squirrel-cage Motor.

The new type of squirrel-cage rotor recently developed by the writer, which satisfies the conditions of high starting torque and low starting current in the line, is such that the rotor conductors have the inherent characteristic property of a relatively high resistance when alternating current of, say, 50 frequency, flows in them, whereas when the currents have the very low frequency corresponding to the rotor slip, the resistance will be practically the same as that given by direct current measurement. In other words, the inherent resistance of the rotor conductors is proportional to the frequency of the alternating current which flows in them.

When the motor starts, currents of the full supply frequency will flow in the rotor bars, and the resistance of the rotor will therefore be automatically high, whereas when the rotor is running at full speed, the currents in the rotor winding will be of the very low frequency of slip, and the resistance, therefore, will be low, and, in fact, will be practically the same as that of a rotor of standard squirrel-cage construction. The conditions, therefore, are established for a high starting torque, whilst at the same time the running characteristics of the motor are unimpaired.

In order that the rotor bars may have the inherent characteristic property just described, a well-known result in the theory of transformers has been utilised. This result may be stated as follows:—

If the secondary winding of a transformer is closed, the effective resistance of the primary winding to alternating currents is given by the expression:—

$$R_1 + \frac{M^2 R_2 \omega^2}{(L_2 \omega)^2 + R_2^2}$$

where R_1 ohms is the primary winding resistance when the secondary winding is open;
where R_2 ohms is the resistance of the secondary circuit;
where M is the co-efficient of mutual induction of the windings;
where L_2 is the co-efficient of self-induction of the secondary winding;
where ω is equal to 2π [frequency of the alternating current.]

The effective inductance of the primary winding to alternating current when the secondary circuit is closed is:—

$$L_1 - \frac{M^2 L_2 \omega^2}{(L_2 \omega)^2 + R_2^2}$$

where L_1 is the coefficient of self-induction of the primary winding.¶

An inspection of the foregoing formula for the resistance shows that, other things being equal, the effective resistance of the primary winding of a transformer of which the secondary winding is closed is dependent on the frequency of the currents which flow in the primary winding. This result is the basic principle of the design of the new type of rotor conductors.

Perhaps the most obvious method of applying this principle is to construct each rotor conductor as illustrated in fig. 1. As will be seen from the illustration, each conductor comprises a central copper rod which is surrounded by a seamless steel tube. The steel tube is coated with copper either in the form of copper foil, or electrolytically copper plated. Between the copper-plated steel tube and the central copper rod is a layer of insulation.

* See, A. Thomaelen: "Zur Geschichte des Induktionsmotors," *E.T.Z.*, August 31st, 1922, p. 1,105. L. Schueler: "Kurzschlussanker oder Schleifringanker?" *E.T.Z.*, August 31st, 1922, p. 1,108.

† See *Journal* of the Institution of Electrical Engineers, Vol. 61, p. 128, January, 1923.

‡ See T. F. Wall, *Engineering*, August 10th, 1923, p. 164.

§ See T. F. Wall, Elec. Rev., July 13th, p. 44; August 10th, p. 208, 1923.

¶ See, for example, *Electrical Engineering*, T. F. Wall, pages 434 and 464.

It will be obvious that the arrangement shown in fig. 1 is a very simple form of transformer of which the central copper rod is the primary winding, the steel tube is the magnetic core, and the copper plating on the steel tube is the secondary winding. Hence, in accordance with the formula already

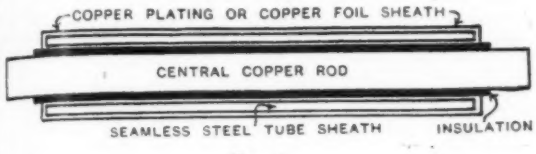


Fig. 1.

given, if alternating current of various frequencies is supplied to the central copper rod, the effective resistance of this rod will increase with the frequency.

In order to confirm that this theoretically deduced result is actually obtained, tests were made on a rod of the following dimensions:—

Diameter of central copper rod ... ... = 0.125 in.
Thickness of wall of seamless steel tube sheath ... = 0.9 mm.
Thickness of copper plating on steel tube sheath = 0.01 in.

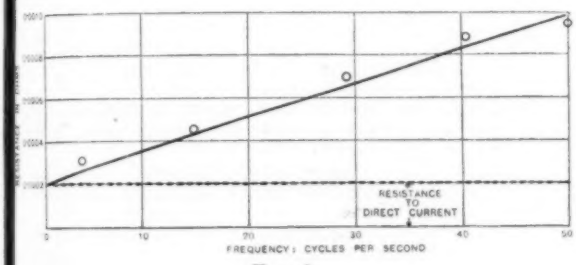


Fig. 2.

The results of the test are shown in fig. 2, from which it is seen that the effective resistance to alternating current is very approximately given by the relationship

Resistance to a.c. = Resistance to d.c. [1+0.06 (frequency)]

The tests also showed that the value of the power factor of this composite rod was practically unity at the higher values of the frequency, and this is an important characteristic of the device.*

Whilst the construction shown in fig. 1 gives the desired result it is not an ideal arrangement from a practical point of view. The inside covering of copper on the steel sheath is a little awkward to apply and also the introduction of an insulating layer between the central copper rod and the plated steel sheath adds to the cost of construction. Further, the copper plating on the steel sheath is only effective during the starting period and will not carry any appreciable current during the normal running period of the motor. This results in a relatively low value for the space factor for the rotor slots and, other things being equal, the size of the motor for a given output when the construction shown in fig. 1 is used would have to be somewhat increased as compared with the size of a standard squirrel-cage motor.

In this connection it is to be observed that the introduction of the steel sheath shown in fig. 1 does not itself imply any appreciable reduction of the space factor, since this steel sheath is effective in carrying a portion of the main magnetic flux of the motor so that the cross sectional area of the rotor teeth may be reduced by an amount corresponding to the cross-sectional area of the steel sheath without involving any appreciable increase of flux density in the rotor teeth.

In view of the foregoing consideration the construction of the composite rotor bars has been very greatly simplified by forming them as *auto-transformers*, as shown in fig. 3. This modified arrangement does not require any insulating layer, neither does it require any copper plating inside the steel sheath.

As shown in fig. 3, over the central copper rod is fitted the steel sheath (a seamless mild-steel tube has been found to be

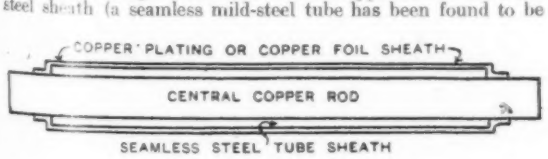


Fig. 3.

very good material for this sheath). Copper plating is then provided over the outer surface of the steel tube, care being taken that this copper plating shall extend so as to make good electrical contact with each projecting end of the central copper rod.

*See Electrical Review, ibid.

One great advantage of the construction shown in fig. 3 is that the copper plating is effective in carrying the rotor current during the normal running period. Hence the space factor of the rotor slots when such bars as shown in fig. 3 are used will be practically identically the same as when the standard rotor construction is employed. This leads to the important conclusion that a squirrel-cage motor built in accordance with this new design need not be any larger than a standard squirrel-cage motor for the same output.

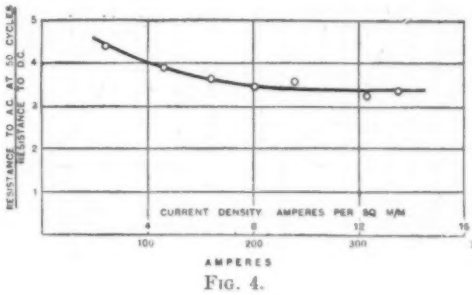


Fig. 4.

In fig. 4 are shown the results of some tests on a composite rod constructed as shown in fig. 3. The data of the rod to which the results of fig. 4 refer are as follows:—

Section of central copper core ... ... 17.5 sq. mm.
Thickness of steel sheath ... ... 2.36 mm.
Thickness of outer copper foil sheath ... ... 0.01 in.

The results given in fig. 4 show that the ratio

$$\frac{\text{Resistance to a.c. at 50 frequency}}{\text{Resistance to d.c.}} = 3.4$$

for a wide range of current values.

In fig. 5 is reproduced a representative oscillogram of the p.d. and current waves for a current of 202 amperes in the rod.

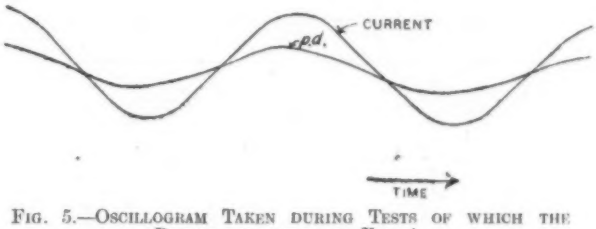


Fig. 5.—Oscillogram Taken during Tests of which the Results are given in Fig. 4.

R.m.s. value of the current = 202 amperes.

Note.—The zero lines for the current and p.d. waves respectively are not coincident.

Performance of a Squirrel-cage Motor with Rotor Conductors as in Fig. 3.

In a recent article† the writer has shown what proportional increase of rotor resistance is necessary to enable the motor to start with a given torque and with a given current in the line.

The same motor as considered in that article will be used for the purposes of the present example. The data of the motor are as follows:—

50 h.p., 8 poles, 50 frequency, 3-phase star-connected stator; supply pressure 500 volts, that is, 289 volts per phase;

Resistance of the stator winding per phase, $r_1 = 0.129$ ohms;
Reactance of the stator winding per phase, $x_1 = 0.605$ ohms;
Resistance of the standard rotor winding per phase when reduced to the stator number of turns, $r_2' = 0.242$ ohms;
Reactance of the standard rotor winding per phase when reduced to the stator number of turns and the stator frequency, $x_2' = 0.231$ ohms.

Reference to fig. 4 shows that if the rotor rods are made in accordance with the data of the rod specified in connection with fig. 4 the resistance of the rotor winding at starting will be about 3.4 times as large as the resistance when the rotor is running at full speed.

In figs. 6 and 7 are given respectively the starting torque and the starting line current as functions of the ratio

$$\frac{\text{effective rotor resistance at starting}}{\text{effective rotor resistance at synchroncus speed}}$$

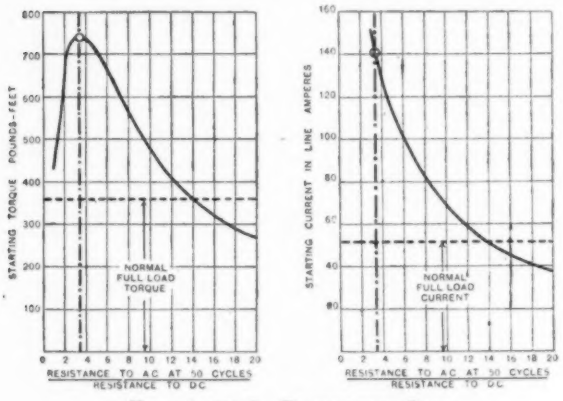
when the supply pressure to the stator is reduced by means of an auto-transformer to (1/1.25) times the main supply pressure.

It will be seen by reference to these curves that if the effective resistance of the rotor winding at starting is 3.4 times the

† See Electrical Review, ibid., also *Engineering*, ibid.

rotor resistance at synchronous speed, the starting torque of the motor will be just over twice the full-load torque and the starting current in the line will be 2.75 times the normal full-load current.

It is of interest to consider the torque-slip and the line


STARTING TORQUE POUNDS-FEET
NORMAL FULL LOAD TORQUE
RESISTANCE TO A.C. AT 50 CYCLES / RESISTANCE TO D.C.
STARTING CURRENT IN LINE AMPERES
NORMAL FULL LOAD CURRENT
RESISTANCE TO A.C. AT 50 CYCLES / RESISTANCE TO D.C.

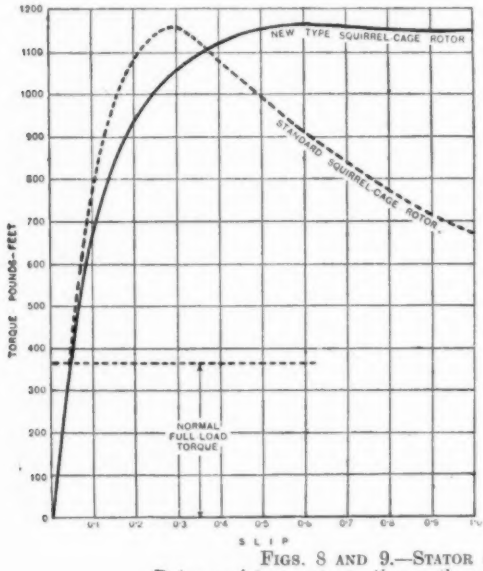
FIGS. 6 AND 7.—TRANSFORMER RATIO.

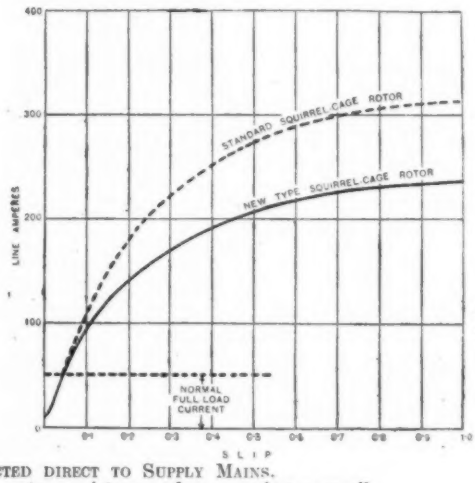
$$u = \frac{\text{Main supply pressure}}{\text{Pressure supplied to the stator at starting}} = 1.25$$

current-slip curves of a squirrel-cage motor of which the rotor winding is formed of composite bars, as illustrated in fig. 3.

Assuming that the value of the reduced effective rotor resistance $R_{2s}{}^1$ at any slip s is given by the expression (see fig. 2):

$$R_{2s}{}^1 = r_2{}^1 + (k - 1)\, r_2{}^1 s$$





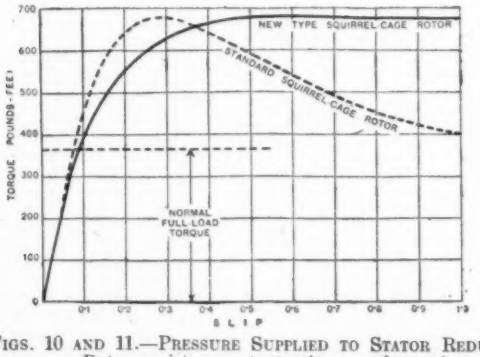
FIGS. 8 AND 9.—STATOR CONNECTED DIRECT TO SUPPLY MAINS.
Rotor resistance at starting = three times rotor resistance when running normally.

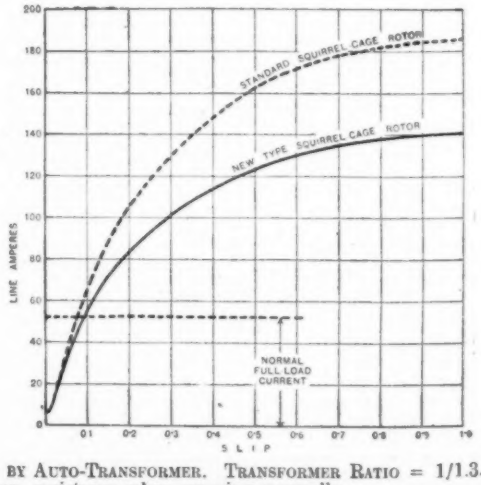
where $r_2{}^1$ is the reduced effective rotor resistance when the rotor is running at synchronous speed, and

$$k = \frac{\text{effective rotor resistance at starting}}{\text{effective rotor resistance at synchronous speed.}}$$

At starting, that is for $s = 1$, the expression reduces to

$$R_2{}^1 = k \,.\, r_2{}^1.$$





FIGS. 10 AND 11.—PRESSURE SUPPLIED TO STATOR REDUCED BY AUTO-TRANSFORMER. TRANSFORMER RATIO = 1/1.3.
Rotor resistance at starting = three times rotor resistance when running normally.

In fig. 8 are given the torque-slip curves for the ratio $k = 3$, for the new type of rotor and for the standard squirrel-cage rotor. It will be observed that whilst the starting torque of the new type of rotor is about 1.7 times the starting torque of the standard rotor, the two curves fall into practical coincidence at about full-load conditions.

In fig. 9 are shown the line current-slip curves for both the standard squirrel-cage rotor and for the new type of rotor. Here, again, it will be observed that whilst for the new type of rotor the line current at starting is only 75 per cent. of that for the standard rotor, the two curves come into practical coincidence at about the full-load conditions.

In fig. 10 the torque-slip curves, and in fig. 11 the line current-slip curves, are shown when the stator pressure is reduced by means of an auto-transformer, the transformation being 1 :1.3.

Another useful method of illustrating the results is given in fig. 12. In this figure the starting torque and stator volts are shown as functions of the stator current for the following values of the ratio k, *viz.*: 1, 2, 3, 4.

Conclusions.

The following is a summary of the advantages which may be expected from the new type of squirrel-cage motor as described in the foregoing, *viz.*:—

(1) High starting torque with low starting current in the line.

(2) Reduced cost as compared with the combination of a standard squirrel-cage motor and the necessary centrifugal clutch or other starting device to enable the standard squirrel-cage motor to start up light.

(3) Retains the inherent characteristic advantages of the standard squirrel-cage motor as compared with the slip-ring motor, amongst which are:—

(i) Absence of any possibility of sparking at the rotor, which therefore permits of its use in explosive atmospheres.

(ii) Reduced cost of upkeep due to absence of slip-rings and brushes.

(iii) Increased efficiency, better power-factor and increased stalling torque.

Discussion.

Prof. F. G. Baily said that the squirrel-cage motor was the best machine, except that it had the unfortunate property that starting was hopelessly bad. There was no friction, no wear and tear, efficiency was very high, and the machine was robust. Dr. Wall's work represented one of the most important improvements in the induction motor which he (Prof. Baily) had heard of for a long time.

Mr. H. Jack also congratulated Dr. Wall on his work. Someone else had been working on these lines in America,

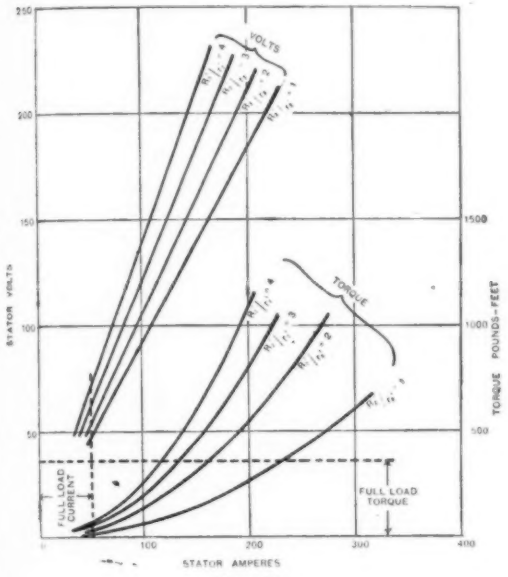


Fig. 12.

and had evolved a similar arrangement in connection with the starting up of synchronous motors. There was a big field for it, for anything which would widen the application of squirrel-cage motors would be of great advantage. Dr. Wall had improved the starting torque considerably but had not brought down the starting current; the use of an auto-transformer was still involved.

Prof. Sir James B. Henderson said it was one of the greatest inventions in asynchronous motor design made during the last twenty years, and was a great step in advance.

Mr. C. Rettie said that the regulation of induction motors was very important, especially with reference to ship propulsion, but Dr. Wall had referred to a fixed voltage. He would like to point out, however, that there was a difference between ship propulsion and land work. On a ship they had fixed voltage; they could bring the voltage up with the generator and could start the motor slowly, an advantage which land work did not possess.

Prof. G. W. O. Howe, after expressing appreciation of the paper, said there was one other defect of the induction motor which had not been mentioned, namely, the low power factor. People at the present day were clamouring for a good power factor, but he was afraid that that was an impossibility so long as they expected the three-phase supply to produce the magnetic flux as well as the torque.

Dr. Wall, in reply to Mr. Jack, said that there were a large number of proposed solutions of this problem in America, but he had searched available records and could find nothing in any of them corresponding to his own. Some eminent American engineers had visited his laboratory, and had referred to work which was being done in America in this connection, but in that case they had a central coil, and, instead of a steel tube, they used a copper tube. With regard to power factor, the squirrel-cage motor had a very much better power factor than the slip-ring motor, and he imagined that, when the results of tests on his machine were given, it would be found that the power factor would be considerably better than that of the slip-ring motor, but not quite so good as that of the standard squirrel-cage motor.

Scientific Exhibition.

The exhibition of scientific apparatus arranged, principally for the edification of the public, during the Association's visit was composed of examples of the products of many well-known firms.

Among the apparatus shown by Messrs. H. W. Sullivan, Ltd., was a selenium magnifier for submarine telegraphy, in which the image of a grid is projected on to the mirror of the receiving galvanometer and thence to a selenium cell of special design. The cell is sub-divided to correspond with the image of the grid. The sub-divisions are arranged in the four arms of a bridge circuit and the image of the grid is so arranged that when the galvanometer is at zero each of the four arms is half "light" and half "dark" and the bridge is then balanced. Deflections of the galvanometer by received signals cause corresponding movements in the image of the grid over the surface of the cell, with consequent changes of resistance in the bridge arms and resulting current in the local receiving apparatus. A magnification of ten or twenty thousand can be obtained in this way. The high-frequency a.c. measuring apparatus shown included a reed hummer generator, standard mica and air condensers, a balanced and screened transformer, valve oscillation generator, &c. In addition to these the firm exhibited broadcasting reception sets, heterodyne wavemeters, Tucker hot-wire microphones, and a large amount of telegraph apparatus.

Messrs. Chance Bros. & Co., Ltd., showed applications of Crookes glass for various purposes.

Prof. A. O. Rankine's "photophone" was demonstrated in one of the rooms. A beam of light was transmitted from the near-by St. George's Hall; this was caused to fluctuate by speech and the fluctuations were reproduced, *via* a selenium cell, in a telephone receiver. Mr. S. G. Brown's "Frenophone" has been employed in connection with this. The "Frenophone" produces a very high magnification of the received signals by means of the friction existing between a polished glass disk and a small cork pad rubbing upon its suface. The disk is rotated by clockwork, and the received telephonic current is applied to the coils of a reed-type receiver; the reed presses on the pad which in turn bears upon the disk. The vibratory pressure of the pad causes large vibratory changes in the frictional drag imparted to the pad; and by linking the pad to a telephone diaphragm, so that it is caused to vibrate as the result of the tangential vibrations due to the drag of the disk upon the pad, very loud speech, &c., is set up in the sound-transmitting trumpet.

Messrs. Tinsley & Co. showed several examples of their potentiometers, standard condensers, vibration galvanometers, and other instruments.

The Lea coal-meter was on view, and Nobel Industries, Ltd., had a cellulose exhibit.

The Marconi International Marine Communication Co., Ltd., showed a receiver for use in connection with the rotating wireless "beam" for navigational purposes, described by Capt. Slee in his paper before Section G (*vide* our issue of September 21st). The other equipment on view comprised a duplex telephone set, a marine direction finder, and a radio installation for a ship's lifeboat.

W. R. Patents, Ltd., showed examples of its CO_2 recorder, and the Sperry Gyroscope Co., Ltd., exhibited one of its gyro compasses in a binnacle.

Messrs. Lionel S. Taylor, the Liverpool representatives of Messrs. Creed & Co., had in operation a high-speed printing telegraph.

The exhibit of X-Rays, Ltd., consisted of a combined screen and couch, a dental X-ray outfit, a "Ped-o-scope" for shoe fitting, X-ray tubes, &c.

The British Insulated & Helsby Cables, Ltd., had a display of wide variety which included condensers for the correction of power factor, a butt welder with a wiring arrangement giving eight "heats," paper pinions, cables, wires, &c.

Instruments were shown by the Record Electrical Co.

An interesting and timely exhibit was the ray track apparatus, invented by Mr. C. T. R. Wilson and modified by Mr. Shimizu, which was shown by the Cambridge & Paul Instrument Co., Ltd. Other apparatus exhibited by this firm included a hydrogen ion measuring equipment for use in industrial processes; a "Cambridge" vibrograph for the recording of vibrations in roads; an instrument for measuring the percentage of CO_2 alveolar air; a stress recorder, &c.

Messrs. Gambrell Bros. had a collection of Wheatstone bridges, galvanometers, potentiometers, high resistances, radio apparatus, and an "emotometer" or "psycho-galvanometer" for the measurement of nerve reaction.

Pyroscopic apparatus was displayed by the Foster Instrument Co.

The stand of the Edison Swan Electric Co., Ltd., bore numerous examples of "Pointolite" lamps, and the Igranic Electric, Ltd., showed honeycomb inductance coils, coil holders, intervalve transformers, potentiometers, and motor control gear.

In addition to the above, the "Optophone" apparatus for enabling the blind to read ordinary print, invented by Dr. E. E. Fournier d'Albe, and developed by Prof. A. Barr, was exhibited and demonstrated.

Cohesion and Molecular Forces.

On Thursday, September 13th, Sections A, B and G—Mathematical and Physical Science, Chemistry, and Engineering—held a joint discussion on the above subject.

Sir William Bragg, F.R.S., who opened the discussion, said that whereas in the past we had been more or less content to investigate the forces affecting aggregates of atoms and molecules, it was now necessary to find out the forces affecting each individual molecule and atom; to ascertain exactly the forces which operat d between each atom and made atoms fit together. Many plausible hypotheses had been put forward in the past, but they had, for the most part, been based on investigations of the aggregate, and not upon the individual atom. If we

regarded the atom as a complex body with various points to which other atoms were attached, then we should begin a movement towards a true investigation of the forces which operated between atoms. The trouble in the past had been not knowing the structure of the atom or the molecule or crystal, and therefore we had been bound to deal with aggregates. It had now been possible, however, to investigate the properties of the crystal, and from that we could continue and ascertain the forces at work in the individual atom. Only in that way should we be able to understand the real nature of cohesion and molecular force.

Dr. W. Rosenhain discussed the problem of metallurgy, and outlined some of the recent work upon the crystalline structure of metals. Fatigue in metals, he said, was due to the phenomenon of "slip" between the particles, and if this could be eradicated, the stronger would the metal become.

Prof. A. A. Griffith spoke on the phenomena of cohesion and molecular force as affecting engineering structures, and outlined certain theoretical problems which, he said, it was necessary to solve before any useful general discussion on the whole problem of these forces could be carried on.

Prof. Sir E. Rutherford, F.R.S., said that in the present state of knowledge it would be difficult to get a general expression for the reaction forces between atoms and molecules. They might hope for most progress along the lines of considering the problem as one of elastic deformation. What the physicist wanted to know was what were the forces between the individual atoms and how they varied.

Sir Oliver Lodge, F.R.S., caused considerable laughter by remarking that it was an astonishing thing that three Sections of the British Association should, at this time in the history of science, meet together to seek to answer the question why, when one picked up one end of a stick, the rest of it came up also. It was impossible to overlook the electrical action between atoms, although other theories had been put forward. Electrons were revolving, and there must be magnetic forces, but there was a good deal yet to learn about it.

Prof. F. A. Lindemann expressed the view that there must be attractive force between atoms or molecules, and he had for years been trying to get some idea of the inter-atomic forces by considering the relations between the compressibility, tensile strength, and the latent heat of evaporation.

Sir Henry Fowler (president of Section G) said that although it was important to know of the forces which kept materials together, yet it was also important for engineers to know why structures sometimes broke down. In those cases engineers could not understand why cohesion had failed.

Prof. P. Langevin also adopted the view that electrical and magnetic forces must be taken into account in considering cohesion.

Prof. F. C. Lea said that another important problem from the practical point of view was to ascertain the nature of the forces which brought about failure in materials or structures under repeated stresses. If anything, that was more important than knowing the forces required to break materials.

The openers of the discussion briefly replied, and it was agreed that in this problem physicists, engineers, and chemists must work together if a true solution was to be obtained.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Ella" Converter.

The "Ella" converter (fig. 1) supplied by Messrs. Lionel Robinson & Co., 3, Staple Inn, W.C.1, is a device for charging 4- or 6-V accumulators from d.c. lighting circuits. It is a simple double-armature machine with one rotor having a commutator at each end. The h.p. side can be directly connected to any d.c. supply between 100 and 250 V.

The machine weighs 15 lb., and its overall dimensions are 6½ in. by 5¾ in. by 8¾ in. length over bearings. It runs at about 2,000 r.p.m. A small control panel is fixed to the frame bearing a regulating resistance, and a pole-indicating ammeter.

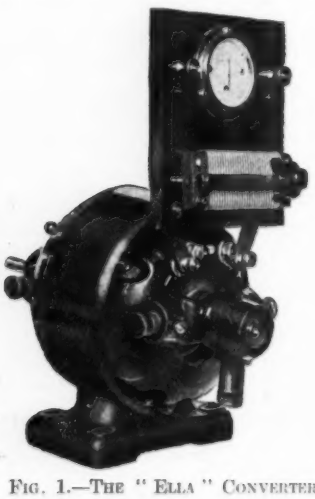


Fig. 1.—The "Ella" Converter.

Fig. 2.—The "Wecovalve."

The Mullard "Wecovalve."

On October 1st the Western Electric Co., Ltd., of Connaught House, Aldwych, W.C.2, and the Mullard Radio Valve Co., Ltd., of 45, Nightingale Lane, Balham, S.W.12, placed upon the market a new 3-electrode thermionic valve of considerable interest. It is known as the "Wecovalve," and is manufactured by the latter company under British Patents Nos. 17,580, 123,126, and 180,090; it is a receiving valve of miniature dimensions (½ in. diameter by 2½ in. long, weighing ¼ oz.), and has a specially prepared filament which may be operated from a single dry cell. The economy to be made by its use will be apparent when it is considered that (*a*) it will eliminate the expense and constant attention that are necessitated by the use of accumulators, and (*b*) its life is claimed to be at least twice as long as that of any other valve at present procurable, either of the tungsten or "dull-emitter" types. Owing to the robust construction of "Wecovalves," the risk of mechanical breakage is reduced, and they are said to have a very low self capacity due to the absence of long leads and pins; they are, therefore, particularly suitable for use in the reception of broadcast and other short-wave signals. The filament current is only 0.25 A, with a filament voltage of from 0.8 to 1.1 V, the detector anode voltage being from 17 to 22 V, and the amplifier anode voltage from 22 to 45 V. It should be noted that when in full operation the filament glows a dull red (not a brilliant white), and that any additional current above that specified does not improve the efficiency, but reduces the life of the valve. The new valve, which is of what is called the pea-nut shape, is said to be remarkably efficient for detecting and for high- and low-frequency amplifying. The destruction of a valve through its careless insertion in the socket or removal is prevented by the adoption of a bayonet cap as shown in fig. 2. Fig. 3 illustrates the "Wecovalve" socket, and fig. 4 the "Wecovalve" 4-pin adaptor, the dimensions of the former being 1¼ in. by ¾ in., and of the latter 1¾ in. by 1¼ in., each weighing one oz. The makers of the new valve recommend that it be used in conjunction with a special filament resistance, and an "A" dry cell that have been developed for the purpose.

Fig. 3.—"Wecovalve" Socket.

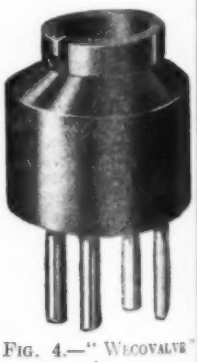


Fig. 4.—"Wecovalve" 4-pin Adaptor.

Device for Pulling Wires Through Conduits.

The usual method of pulling wires through conduits involves the use of a stiff wire to which is secured a spherical head. This head is very liable to catch up at sockets and on bends, and should the position of these be at some distance from the point of entry it becomes a matter of difficulty to force the head past the obstruction owing to the buckling of the wire.

To avoid such difficulties, Mr. T. W. Nixey, No. 13, H

Block, Sutton Buildings, Cale Street, Chelsea, S.W., has patented a new form of head for attachment to the drawing-in wires. This device, which is illustrated in fig. 5, has two wheels ¾ in. in diameter fixed at right angles to one another, or, if required, three wheels at different angles can be fitted.

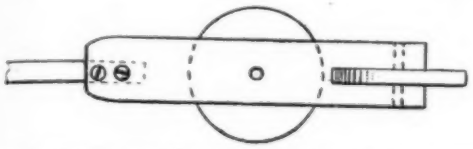


Fig. 5.—Device for Pulling Wires through Conduit.

It will be seen that these wheels, which run very freely, facilitate the passing of obstacles, one of them being bound to come into action. The head has a length of about 1 in. overall.

Cable-Testing Instructions.

We are indebted to Mr. F. C. L. Sabine for the photograph reproduced in fig. 6, which was taken by him at the Telegraph Construction & Maintenance Co.'s works at East Greenwich, showing the instruments manufactured and fitted

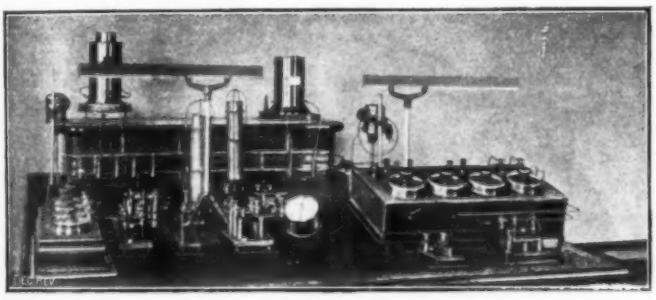


Fig. 6.—Cable-Testing Instruments.

by that firm for the use of Messrs. Clark, Forde & Taylor's (consulting engineers) representative in the factory, who has to take a large number of electrical tests in the course of the manufacture and shipment of a submarine cable.

The set is divided into two halves; that on the left of the photograph is for the measurement of copper resistance, and consists of a T.C. & M. galvanometer, directly reflecting on to a transparent scale, a T.C. & M-pattern Wheatstone bridge, and short-circuit and battery keys.

The right-hand set is for insulation and capacity tests, and consists of a Riddle galvanometer (330,000 meg. constant with 100 cells) also directly reflecting on to a transparent scale, a universal shunt, short-circuit and battery keys, reversing key, and a switch giving battery powers of 10, 50, 100, and 200 cells.

The remaining fittings consist of a standard megohm, standard ½ mf condenser, and terminals for plain and concentric leads and earth connections, all of which are so arranged that any particular instrument can be connected or disconnected merely by changing plugs.

The whole set is wired with stout rigid copper wire connections coated with enamel, and the result, we are assured, is the most up-to-date and accurate set it has ever been Mr. Sabine's lot to test with.

A New Shop-window Reflector.

Messrs. A. W. Beuttell, Ltd., of 53, Victoria Street, S.W.1, manufacturers of "Linolite" and "Tubolite" fittings, have recently produced a new reflector for shop-window lighting (fig. 7), which takes 60-W or 100-W standard gasfilled lamps.

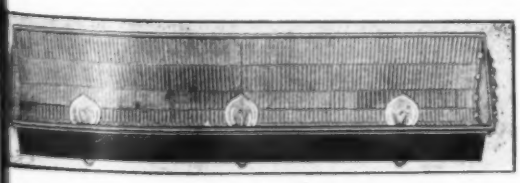


Fig. 7.—A New Shop-window Reflector.

This reflector has a stout sheet-metal frame in which is placed silvered fluted glass. It is of special shape and accurately designed, and the frame of the reflector screens the source of light from the view of persons standing on the pavement. The fitting is suspended from the ceiling by means of chains placed at its ends.

Although strongly made and efficient in operation, this reflector is of comparatively small size, the standard opening being 7 in. wide; any desired length can be made to requirements. Ample ventilation is provided.

A New "Carron" Fire.

Among new designs of electric fires produced by Carron Company, of Carron, Stirlingshire, is that illustrated in fig. 8. This consists of two separately-switched 1-kW units mounted in a cast-iron frame, simply ornamented. The fire is plainly for utility and not decoration, possessing a large radiation surface. A small removable trivet is fitted at the base of the fire. The fire is 14½ in. wide and 20½ in. high,

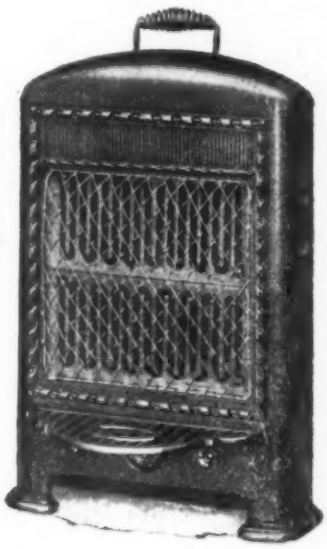


Fig. 8.—A New "Carron" Fire.

and weighs about 21 lb. There are four standard finishes, *viz.*: art black, armour bright, porcelain enamelled, and electro-bronze.

Fuel Economy in a French Station.—In the quarterly *Fuel Economy Review*, published by the Federation of British Industries, appears the following extract from a speech recently made by M. Koopman-Lorand, of l'Est de la France, regarding this company's generating station: "At the beginning of 1919 it was found that 1,600 grammes (roughly 3½ lb.) of coal were being burnt to generate one kWh. At this time there was no control in the boiler-house; fuels were mixed in a haphazard manner, flues and dampers were unregulated, whether the boilers were being forced or working on light load. In April, 1919, an organisation was set up for controlling operations inside the boiler-house for the purpose of economising fuel. Coal meters were installed and analyses of fuel carried out, and of greater importance was the fact that the stokers were seriously trained. Since June, 1919, the consumption of fuel per kWh has decreased by almost 200 grammes (that is, 12½ per cent.), which for the month of July, 1919, represented an economy of 1,000 metric tons, in value 150,000 fr. Continuously since this time valuable progress has been made. Controlling apparatus and measuring apparatus have been installed for each boiler, and consumption has been diminished, especially with reference to the calorific power of the coal burnt. In October, 1921, the consumption was down as low as 936 grammes (2 lb.) per kWh, showing a reduction of over 40 per cent. on the consumption of the first three months of the year. In order to realise the magnitude of this, taking the figure of 45 millions for the kWh produced in 1920 and the same consumption per kWh as at the beginning of 1919, the gain in fuel saved represents 27,000 metric tons, and at the price of fuel then prevailing a sum of 4,320,000 fr."

The above is a striking example of the possibility of effecting large savings in power production costs by paying sufficient scientific attention to the boiler-house.

Lantern Slides.—Intending lecturers are reminded that Messrs. E. Bennis & Co., Ltd., 28, Victoria Street, London, S.W., have a large number of lantern slides of mechanical stokers and mechanical coal and ash-handling plant available for loan to societies, institutions, or individuals. A booklet has been prepared giving particulars and numbers of slides, and copies will be sent on application. Outline lectures can also be provided.

NEW PATENTS APPLIED FOR, 1923.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEPTON-JONES, O'DELL AND STEPHENS, Patent Agents, 285, High Holborn, London, W.C. 1.

23,183. "Wireless receiving set." A. H. Bridger. September 17th.
23,199. "Electric terminal, &c." P. Taberner. September 17th.
23,203. "Wireless detector." Hall Bros., J. H. Hall, S. E. Hall, and H. H. Ratcliff. September 17th.
23,207. "Panel construction of wireless apparatus." W. R. Gothard. September 17th.
23,208. "Frame aerial." W. R. Gothard. September 17th.
23,218. "Sparking plugs." H. Ford and G. H. Taylor. September 17th.
23,244. "Electric furnaces." F. S. Patterson, J. H. Patterson, and R. N. Patterson. September 17th.
23,245. "Selective switching systems." F. R. McBerty. September 17th.
23,247. "Commutators for ignition systems of internal-combustion engines." A. V. Ryder. September 17th.
23,253. "Transmission of electro-magnetic waves by thermionic tubes." Dr. E. F. Huth Ges. and L. Kuhn. September 17th. (Germany, September 16th, 1922.)
23,260. "Electric lamps." T. S. L. Mann. September 17th.
23,262. "Radio-direction indicating systems." A. G. L. McNaughton and W. A. Steel. September 17th.
23,266. "Automatic control equipments." British Thomson-Houston Co., Ltd. September 17th. (United States, November 29th, 1922.)
23,272. "Coil holder." C. H. Clark. September 18th.
23,273. "Radio instrument." C. H. Clark. September 18th.
23,288. "Circuits of wireless receiving apparatus." Cooke & Whitfield Wireless, Ltd., and H. H. Whitfield. September 18th.
23,295. "Electric inductance coils, &c." C. K. Brough. September 18th.
23,304. "Apparatus for transmission of wireless signals." D. S. B. Shannon. September 18th.
23,312. "Wireless receiving sets." F. A. Camm and L. Manning. September 18th.
23,329. "Device for terminals for wireless apparatus." G. Evans. September 18th.
23,336. "Transmission and distribution of electrical energy." A. H. Seabrook. September 18th.
23,340. "Amplifier for electric oscillations." Signal Ges. September 18th. (Germany, September 18th, 1922.)
23,343. "High-frequency signalling systems." Grimes Radio Engineering Co., Inc. September 18th. (United States, September 19th, 1922.)
23,347. "Electric protective systems for telegraph, &c., circuits." Metropolitan-Vickers Electrical Co., Ltd. September 18th. (United States, September 20th, 1922.)
23,359. "Remote-control systems." R. C. Arter. September 18th. (United States, January 17th.)
23,362. "Loud-speaking telephone." J. R. Beard, F. R. Griffiths, and Sterling Telephone and Electric Co., Ltd. September 18th.
23,370. "Electric arc devices." British Thomson-Houston Co., Ltd. (General Electric Co.). September 18th.
23,377. "Arrangements for operating electrical apparatus." Automatic Telephone Manufacturing Co., Ltd., and A. E. Hudd. September 18th.
23,378. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., R. Mercer, and F. Tench. September 18th.
23,379. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., R. Mercer, and F. Tench. September 18th.
23,380. "Sparking plugs." A. G. Brown and Brown Pistol Sparking Plug, Ltd. September 18th.
23,390. "Anti-dazzling device for head-lamps." C. A. Willis. September 19th.
23,392. "Electrode for producing electric light." D. Macdonald and R. F. Macdonald. September 19th.
23,401. "Sound-reproducing apparatus." J. G. A. Kitchen. September 19th.
23,419. "Wireless receiving apparatus." W. S. Worthington. September 19th.
23,421. "Telephone earpieces and means for attaching same to head-'phones." C. J. Coleman. September 19th.
23,442. "Dynamo-electric machines." English Electric Co., Ltd., and G. Schroeder. September 19th.
23,445. "Methods of treating conductors." British Thomson-Houston Co., Ltd. (General Electric Co.). September 19th.
23,451. "Rheostats." T. N. Cole, R. P. Richardson, and G. L. Ward. September 19th.
23,458. "Electric current interrupters for ignition magnetos, &c." M.L. Magneto Syndicate, Ltd., and E. A. Watson. September 19th.
23,459. "Ignition magnetos." M.L. Magneto Syndicate, Ltd., and E. A. Watson. September 19th.
23,464. "Apparatus for operating high-vacuum pumps for mercury-vapour rectifiers." Akt. Brown, Boveri et Cie. September 19th. (Germany, September 25th, 1922.)
23,466. "Coil holder for wireless apparatus." H. L. Wood. September 19th.
23,471. "Spark inspector for internal-combustion engines." H. Hodkinson. September 20th.
23,488. "Electric fuses." J. H. Bennison and F. Pape. September 20th.
23,498. "Electric perforator." F. G. Parrett. September 20th.
23,499. "Clips for electric cables, &c." W. H. Beech and H. Smith. September 20th.
23,501. "Electric battery lamps." W. E. Bladon. September 20th.
23,522. "Electric switches." C. W. Denny. September 20th.
23,525. "Device for amplifying wireless signals, &c." W. T. Carter. September 20th.
23,534. "Transformers for telephony, &c." T. V. Ackland and W. E. Ackland. September 20th.
23,541. "Lighting sets for motor vehicles." P. F. W. Bush and L. F. Foley. September 20th.
23,547. "Electrical leading-in conductors." H. G. Bell and Metropolitan-Vickers Electrical Co., Ltd. September 20th.
23,552. "Electromagnetically-operated sound producer." H. W. Parker. September 20th.
23,566. "Electric heaters." J. Schlupek. September 20th. (Czecho-Slovakia, October 30th, 1922.)
23,571. "Electric signs, &c." Strand Electric and Engineering Co., Ltd. (Norden). September 20th.
23,576. "Apparatus for wireless telephony, &c." A. R. Angus. September 20th.
23,585. "Wireless telephone leads." G. C. Clark. September 21st.
23,592. "Trolleys for collecting electricity." T. Corcoran and R. Mahon. September 21st.
23,597. "Wireless receiving apparatus." S. R. Quigley. September 21st.
23,616. "Wireless transmission apparatus." G. T. Shelley. September 21st.
23,626. "Rotary-current motors." A. R. M. Sankey. September 21st.
23,631. "Electric terminals, connectors, &c." A. S. Cubitt and R. F. Tummer. September 21st.
23,649. "Lamps for motor vehicles." W. F. M. Rose. September 21st.
23,650. "Tuning stands for wireless apparatus." Igranic Electric Co., Ltd., and A. H. Mackley. September 21st.
23,653. "Horns, &c., for sound-reproducing instruments." Sterling Telephone and Electric Co., Ltd. September 21st.
23,656. "Electric conductors." British Thomson-Houston Co., Ltd. (General Electric Co.). September 21st.
23,665. "Ignition timing devices for internal-combustion engines, &c." E. J. H. Whyte. September 21st.
23,680. "Hanger straps for passengers in tramcars, &c." A. Gottlieb. September 21st.
23,690. "Electric heating apparatus." R. Crust. September 22nd.
23,691. "Electric hair-waving appliances." F. B. G. Ellis and G. E. Pearson (Voss). September 22nd.
23,698. "Combined electric switches and couplings." J. A. Crabtree. September 22nd.
23,728. "Electric inductance coils." C. F. Halsall. September 22nd.
23,735. "Holder for telephone headpieces." L. E. Richards. September 22nd.
23,752. "Electrical transformers." F. E. Berry. September 22nd.
23,753. "Means for obtaining electric current of one phase from electric current of a different phase." F. E. Berry. September 22nd.
23,754. "Voltage regulators for alternating-current circuits." F. E. Berry. September 22nd.
23,755. "Electric switches." British Thomson-Houston Co., Ltd., and A. S. FitzGerald. September 22nd.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1922.

6,518. "Telephone systems." W. Muller. March 4th, 1921. (176,384.)
9,997. "Long telegraph poles." Western Electric Co., Ltd. August 10th, 1921. (184,774.)
12,147. "Sound reproducers." C. M. Streete. May 1st, 1922. (203,364.)
12,439. "Generators of electric lighting sets for motor vehicles and the like." W. J. Nicholas and P. J. W. Roberts. May 3rd, 1922. (203,365.)
13,460. "Checking apparatus for telephone calls." Oilless Bearing Co., Ltd., O. & S., and R. B. Wiggins. May 12th, 1922. (202,048.)
13,525. "Movable supports for electric light, gas, and other purposes." J. Dugdill. May 13th, 1922. (202,051.)
15,408. "Electro-magnetic separators." H. R. Jones and C. E. Wood. June 1st, 1922. (203,374.)
15,472. "Electrical protection systems." J. P. Williams. June 1st, 1922. (203,380.)
15,494. "Electrical controllers." C. L. Browne and S. H. Heywood & Co., Ltd. June 2nd, 1922. (203,381.)
15,516. "Electric arc devices." P. Freedman. June 2nd, 1922. (203,382.)
15,830. "Controllers for electric circuits." British Thomson-Houston Co., Ltd., and R. D. Given. June 7th, 1922. (203,396.)
15,965. "Sparking plugs for internal-combustion engines." O. E. Jones. June 8th, 1922. (Cognate application, 6,479/23.) (203,403.)
16,035. "Sparking plug, with provision for priming and relieving compression." H. J. Brocklebank and V. S. A. Phillips. June 9th, 1922. (203,408.)
16,062. "Thermionic tubes." E. Habann. October 14th, 1921. (Addition to 182,105.) (187,202.)
16,442. "Rendering of line capacity of telephone cables uniform." British Insulated and Helsby Cables, Ltd., and F. Mercer. June 14th, 1922. (203,419.)
16,670. "Diaphragms of sound-recording and reproducing instruments." R. D. Howard. June 16th, 1922. (203,424.)
16,791. "Electrical fuse and switch contact clips and cable blocks." C. A. Wootton. June 17th, 1922. (203,427.)
17,482. "Anti-dazzle devices for headlights for motor vehicles and the like." E. Morgan. June 24th, 1922. (203,439.)
17,842. "Wireless signalling systems." British Thomson-Houston Co., Ltd. (General Electric Co.). June 28th, 1922. (Addition to 192,346.) (203,446.)
17,921. "Electric transformers." British Thomson-Houston Co., Ltd. (General Electric Co.). June 29th, 1922. (203,447.)
18,134. "Wireless receiving apparatus." C. K. Chandler. July 1st, 1922. (203,451.)
18,190. "Electric fuse." R. Marr. April 16th, 1923. (203,452.)
18,226. "Air-cooling systems." Metropolitan-Vickers Electrical Co., Ltd. July 2nd, 1921. (182,491.)
18,549. "Electrical switches." H. W. Cox. July 6th, 1922. (203,460.)
18,694. "Electric heating devices." British Thomson-Houston Co., Ltd. (General Electric Co.). July 7th, 1922. (203,463.)
18,722. "Electric switches, circuit closers, and the like." D. R. Davies and Metropolitan-Vickers Electrical Co., Ltd. July 7th, 1922. (203,465.)
20,483. "Devices for the transmission of electric currents between relatively movable solid conductors by means of liquid conductors, particularly amalgams." R. Erban and A. Madle. July 26th, 1921. (183,836.)
21,588. "Safety device for use with electrical precipitation apparatus." L. Lodge and Lodge-Cottrell, Ltd. August 8th, 1922. (203,489.)
21,933. "Terminal connections for electrical apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.). August 11th, 1922. (203,494.)
22,869. "Automatic switching apparatus for electric distribution systems." British Thomson-Houston Co., Ltd. (General Electric Co.). August 22nd, 1922. (203,507.)
23,020. "Electrically-heated soldering irons." Siemens Bros. & Co., Ltd., and C. R. Riber. August 24th, 1922. (203,510.)
24,122. "Receiving apparatus for wireless signalling." H. P. P. Rees. June 1st, 1923. (203,517.)
27,070. "Protectors for the connecting ligatures of suspended insulators." A. Renaudin. October 6th, 1922. (Addition to 186,632.) (203,552.)
27,172. "Electrical switchgear." W. A. Coates and Metropolitan-Vickers Electrical Co., Ltd. October 7th, 1922. (203,555.)
27,316. "Clockwork-actuated electric switches." W. F. Winterling. October 9th, 1922. (203,556.)
28,387. "Air-scrubbing and cooling devices for alternators." M. L. Fouret. October 29th, 1921. (187,963.)
28,813. "Electric motor-driven compressors." G. J. Spohrer. October 23rd, 1922. (203,564.)
29,057. "Manufacture of paper-insulated electric cables and paper therefor." Hydroloid, Ltd. (Exportingenieur für Papier und Zellstofftechnik Ges.). October 25th, 1922. (203,566.)
31,582. "Electrical ignition apparatus for internal-combustion engines." F. H. Royce and Rolls-Royce, Ltd. November 18th, 1922. (203,585.)
33,615. "Multiple-way selector electric switch." F. H. Madsen. December 8th, 1922. (203,595.)
34,437. "Electrically-controlled lifts and the like." Waygood-Otis, Ltd. (Otis Elevator Co.). December 18th, 1922. (203,602.)

1923.

4,260. "Posts for supporting electric conductors and the like." Himmelbach Akt. Ges., Geb. July 10th, 1922. (200,478.)
8,881. "Luminous electric signs." F. H. Eeles. March 28th, 1922. (203,634.)
10,482. "Electric incandescent lamps." N. P. Pedersen and N. F. Prass. July 28th, 1922. (201,525.)
11,324. "Spark-synchronising device for engaging engines with a common propeller." Soc. Anon. des Ateliers d'Aviation L. Breguet. December 16th, 1921. (Divided application on 190,465.) (196,928.)
15,050. "Magnetically-controlled vacuum tube devices and methods of operating the same." British Thomson-Houston Co., Ltd. June 9th, 1922. (Addition to 169,889.) (199,038.)